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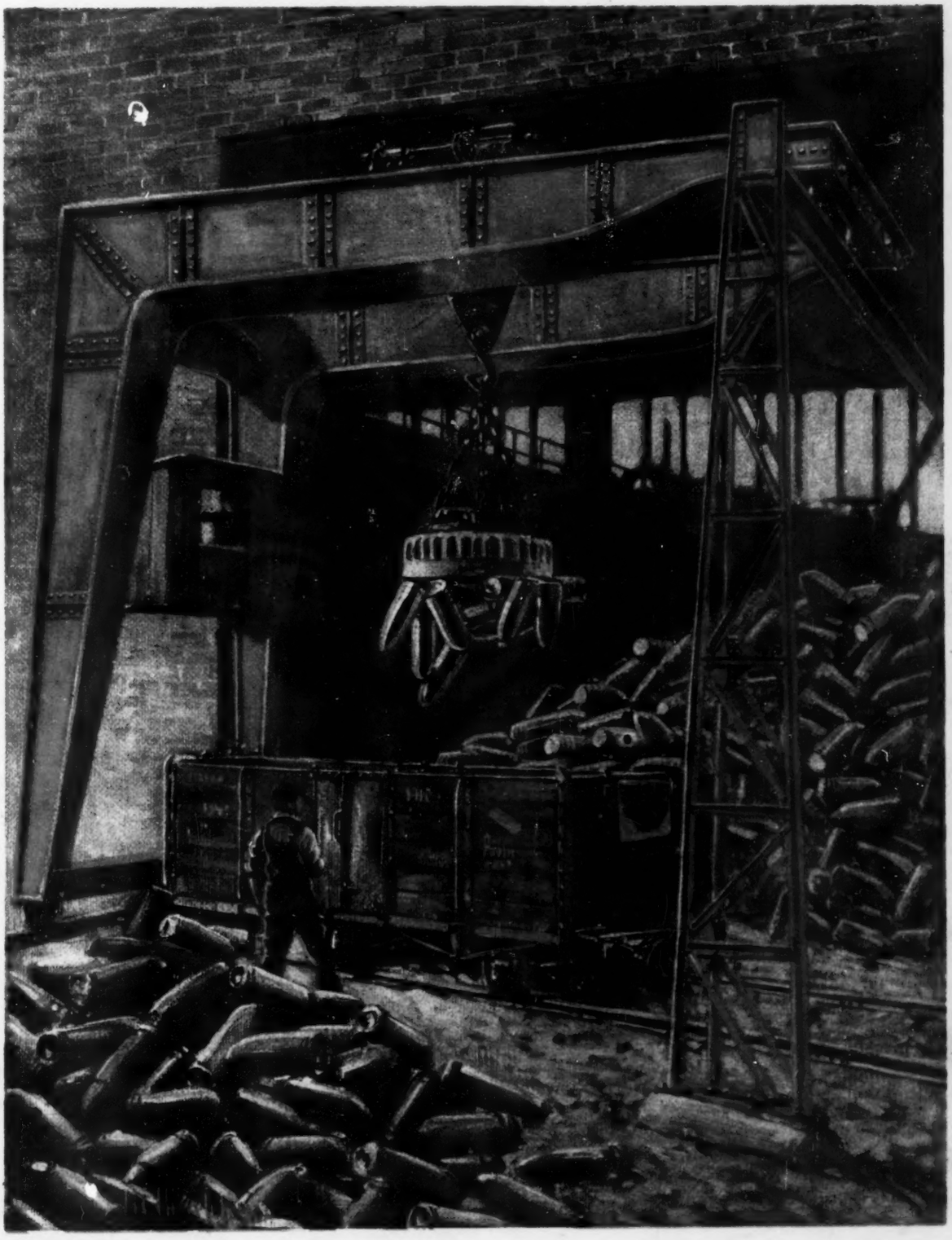

IN A GERMAN STEEL PLANT—TURNING SHELL INTO PLOWSHARES [See page 624]

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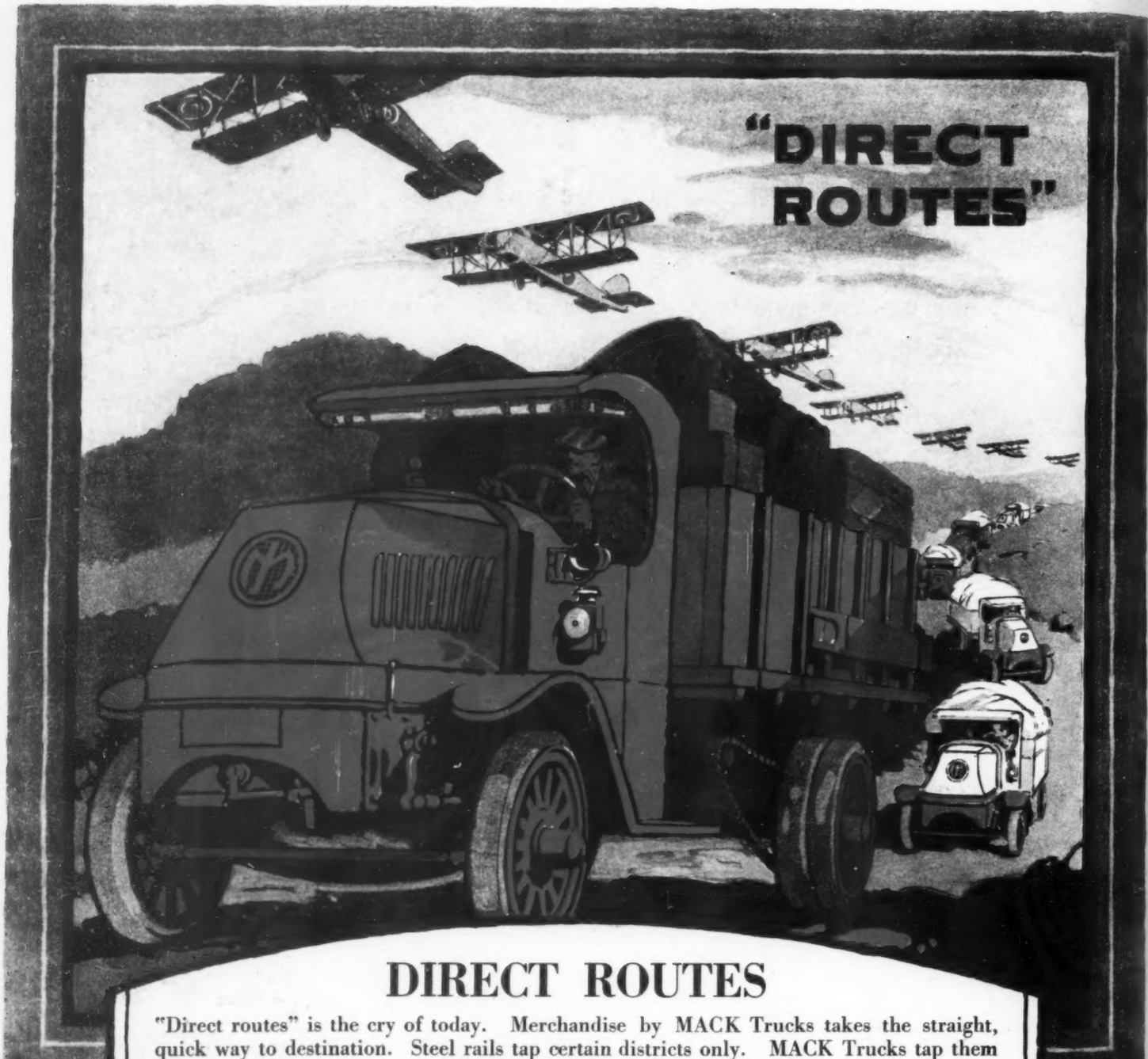

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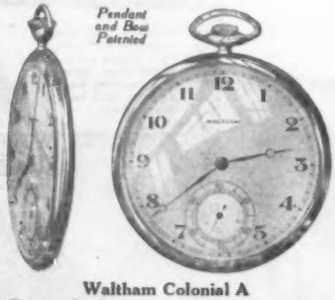

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Maximus movement 21 jewels
Riverside movement 19 jewels
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Know Something About the "Works" In the Watch You Buy

IF you open your watch and examine its mechanism, you will find it consists substantially of two supporting plates, between which is mounted a gearing of meshed wheels to take care of the movement, recording time. This is called the train, which we will speak of in our next advertisement.

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No hand work could ever approximate the beautiful and flawless exactitude of this Waltham drilling and threading.

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WALTHAM

THE WORLD'S WATCH OVER TIME

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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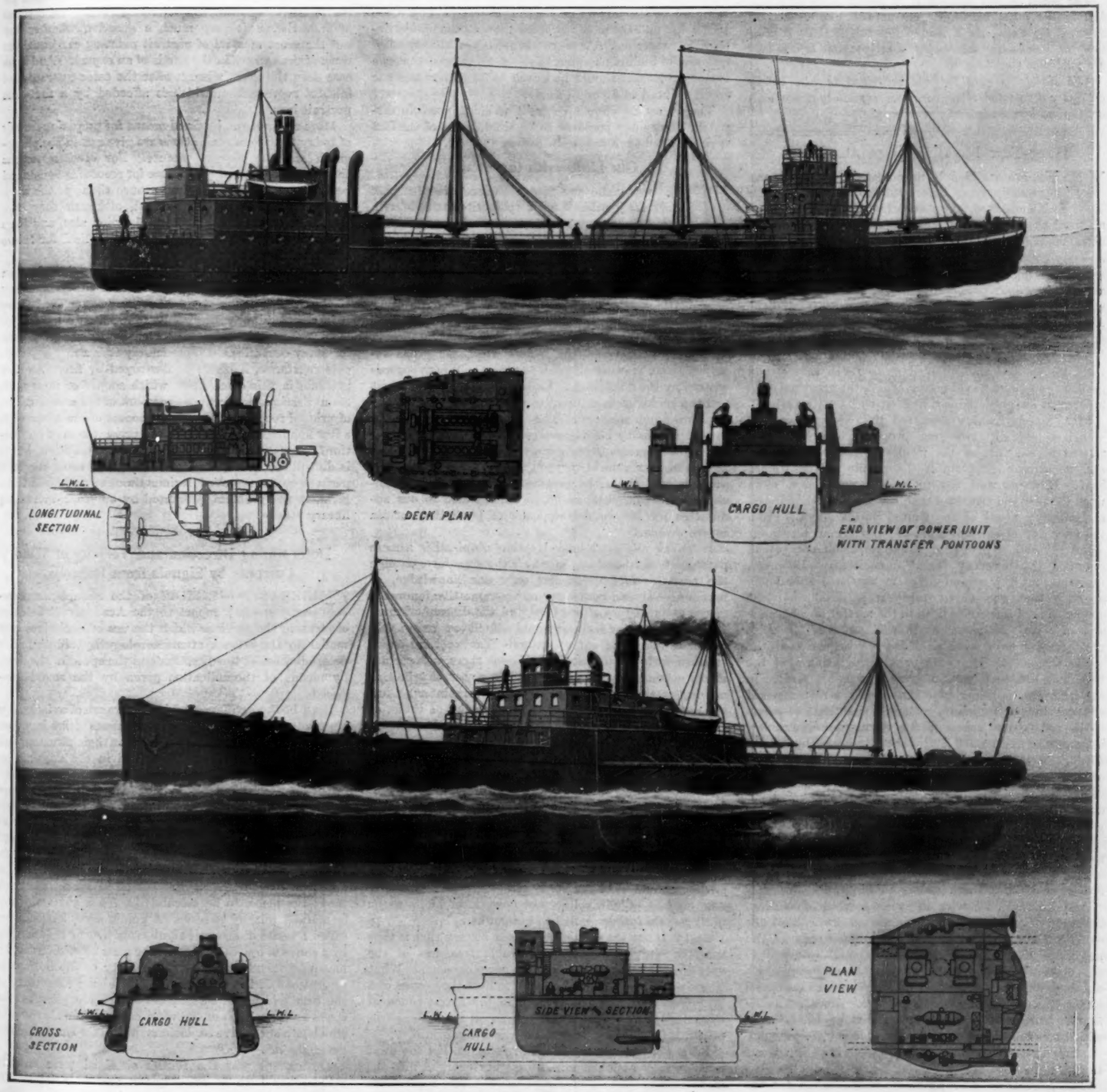

THE LOCOMOTIVE OF THE SEAS

A detachable power plant for the steamships, showing two suggested arrangements—(See page 628)

SCIENTIFIC AMERICAN

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Three-Year Naval Program Abandoned

WE are gratified to note that in his testimony recently given before the House Naval Affairs Committee, the Secretary of the Navy announced that the second three-year naval program had been abandoned. The SCIENTIFIC AMERICAN was strongly opposed to this program on the grounds that it was both inexpedient and unnecessary—inexpedient, because it would tend to destroy the excellent feeling which had sprung up between the United States and the Allies as the result of our participation in the war; unnecessary, because the joint effect of the construction of our first three-year program and the elimination of the German fleet had enabled us to reach that strong position as second naval power, which the great national movement for preparedness had set as its ultimate goal.

Mr. Daniels frankly admitted that the proposal to launch a second three-year program was intimately related to the fate of the proposed league of nations, and he cannot complain if the people of the United States believed that the movement was based more upon the political situation than it was upon the material and military needs of the United States Navy. From the very day of the surrender of the German Fleet, our Allies favored a policy of naval retrenchment, which rendered the big-navy threat unnecessary. However, the fact that the second program has been abandoned suggests that the Government is satisfied that the coöperation of our Allies both in the matter of the league and of naval disarmament is well assured. If these great results have been achieved we believe that the whole nation will join with us in recognizing that the President has performed a great and noble service in the interests, not merely of the sorely stricken world of today but of humanity at large for all time to come.

We have been asked if the SCIENTIFIC AMERICAN believes that the United States should possess a powerful Navy. Most certainly we do; and for over a quarter of a century, as our files will show, we have endeavored to awaken the people of the United States and its Congress to the necessity for building a Navy commensurate with the ever increasing population, wealth, and responsibilities of this great republic. With the completion of the 1916 three-year program we shall be in possession of a magnificent Navy, greatly exceeding in power the Navies of the next three leading naval powers.

And just here we wish to speak a word of caution: It would be disastrous in response to the call of the country for a rapid demobilization, if we reduced the personnel of our Navy too greatly, and returned to that state of undermanning and shortage of officers which obtained before the war. A ship half-manned and under-officered is less than 50 per cent efficient. Therefore let us see to it that our splendid ships, the latest of which are superior to anything afloat, have every advantage that full crews and a complete staff of officers can give them.

The 1916 three-year program, which called for the construction of 10 dreadnought battleships, 6 battle-cruisers, and 10 scouts, with a number of destroyers, submarines and miscellaneous craft, was neglected, during our participation in the war, in favor of destroyers and other vessels suitable to meet the submarine offensive. It is that great program which the Secretary now wishes to push energetically to completion.

Of the battleships, four, of 32,600 tons, are under construction. These ships will mount, each, eight of the powerful 16-inch guns. The other six will be even larger and more powerful. On a displacement of 43,200 tons they will mount 12 16-inch guns and they will have a speed of 23 knots. They will be 684 feet in length, 106 feet in beam, and their mean draft will be 33 feet. These dimensions are, for a battleship, enormous; at full draft they must displace over 45,000 tons.

The six battle-cruisers, 850 feet in length, will carry eight 16-inch guns. The efforts of the SCIENTIFIC AMERICAN to have the original design changed so as to bring all of the boilers below the protective deck were successful, and the modified plans show all the boilers below the waterline. As a compromise on the debated question of building composite ships, we suggest that the armor protection should be raised to 12 inches and the speed reduced to 32 or 33 knots.

The 10 scouts should be built with all possible dispatch. Our navy possesses not a single scout of the fast type that did such fine work during the war.

Our Links with the Past

THE avalanche progress of science in the past centuries justifies a most optimisitc attitude with regard to the prospect of future developments. Nevertheless, there are certain special kinds of problems the complete solution of which presents difficulties of an altogether peculiar character, such that we may well hesitate to extend to these the same confidence of successful attack which we justly entertain towards other subjects of scientific enquiry.

Historical problems, in particular, are thus baffling in character. The time-worn face of the present has betrayed to us many a story of the past. Where records written by the hand of man foresake us, the archaeologist and the geologist have taught us to decipher the writing of nature upon the rock. The embryologist has filled in further details by his discovery that the development of the living organism from germ to adult stage epitomizes in abridged form the history of the race. The astronomer perhaps, can claim the greatest accuracy in his reconstruction of the past, as he is entitled also to our admiration for his wonderful power of predicting certain future events.

But after all, the knowledge thus obtained is a mere patchwork of fragments, in which the gaps far outweigh the positive data. Consider only our knowledge, or perhaps we should rather say our comparative ignorance of the early history of our race, and the descent of man.

What consuming interest would attach to a reasonably complete album of our ancestors! Yet we have to be satisfied with a skull here, a jaw-bone there, a few ornaments entombed with their erstwhile owner, a primitive carving or the work of some prehistoric painter genius, the residues of a camp fire, and such relics as these, as the evidence from which imagination and scientific reasoning must piece together, here a chapter and there a chapter, the early history of the human race.

Nor does it seem as if in this matter the progress of science could ever greatly help us. More and more will, undoubtedly, be learned of the past. But the number of fossils shrouded in the earth's crust is necessarily limited.

Only a diminutive portion of all living beings leave recognizable permanent trace after their death. Unless science should discover some altogether undreamed of new method of unravelling the past, most of its pages must remain forever sealed to human ken.

And it is not the gray dawn of our history that is thus sunk in oblivion. Some memorable treasures of the very near past seem forever lost to our possession. What would not the lover of music give to hear the strings of a Stradivarius respond once more to the magic touch of Paganini's bow? But science, with all its accomplishments, is impotent to restore the voice that is still.

From the discouraging task of resuscitating the dead past we may with advantage turn our energies into the more fruitful channel of preserving for future generations a competent record of the present. And here modern science comes readily and abundantly to our aid. Not that elaborate means are always required to fulfill the purpose. Much can be done by very simple means. The indifference of past generations to family history is often astounding. When we reflect how simple a matter it is to keep a family chronicle, it seems absurd that it should require special research, often with incomplete success, to trace relationship, to say nothing of hereditary traits, a few generations back. Modern scientific interest in the laws of natural inheritance and in the eugenic movement based thereon should result in improvement in this matter. But perhaps more effective than any attempts to persuade people to give attention to these things is the direct assistance afforded by photography. Until about one hundred years ago the possession of tolerably good family portraits was the privilege of the fairly well-to-do. At the present day not only is the family photograph album within the reach of all, but even for the favored few who can afford to retain the services of an artist, it is very much a question whether any but the great masters of portrait painting can equal the work of the camera in the hands of an expert. And in no case does the artist's brush offer the same guarantee of faithful reproduction which is afforded by a first-class portrait lens.

More elaborate and refined means for preparing records of today for future generations are given us in the phonograph and the moving picture. For obvious reasons these have been employed rather for recording events and performances of national importance than for the satisfaction of the private individual, although they offer attractive opportunities in that direction also, and there seems to be presented here a promising field for future commercial exploitation.

A matter which seems to deserve more thought than it commonly receives is the question of the permanency of the records laid down in our libraries. That paper is in a general way admirably adapted as a vehicle for historical records is fully attested by its universal use for many centuries. Unfortunately it is a rather perishable substance, liable to be destroyed by fire. Another problem in this connection, which sooner or later must assume serious proportions grows out of the accumulation of printed records. What will become of our libraries in a few hundred years' time, at the present rate of publication? Today this may be an academic question, but it is difficult to avoid the conclusion that some day, not perhaps so far removed, serious thought will have to be given to the problem presented by our ever increasing library stacks.

Determining Direction and Velocity of Wind Currents by Signals from Balloons

GENERAL BOURGEOIS of the French army recently made a report to the Academy of Sciences concerning the services which the use of explosives may render to the science of meteorology by aiding in the determination of the direction and the speed of the wind, by means of the indication given by the sound produced.

Both in the artillery and in the branch of aviation it is very important to know what currents exist in upper portions of the atmosphere as well as their direction and their strength. This is determined in the daytime by means of sounding balloons, but the use of these must be foregone at night and in cloudy or foggy weather. Hence the following method was devised. A balloon is sent up containing torpedoes so arranged as to explode at regular intervals. Thus the balloon can still be heard and its whereabouts thus determined in spite of its having become invisible. The explosions are registered by apparatus which enables the points in space, at which they take place, to be calculated. Thus the trajectory is marked out by a series of points by what may be called a series of acoustic signboards just as it is marked by a series of optical signals in the method of sounding by means of theodolite. By the totality of the horizontal projections of the bursting points and the knowledge of the time which has elapsed between the explosions, the speed and direction of the wind between the altitudes at which two successive explosions take place can be readily determined.

During the war the results obtained were entirely satisfactory both to artillerymen and to aviators. It will be desirable, therefore, to continue the employment of a method which permits the exploration of the movements which take place in the troposphere.

Naval and Military

Mooring Towers for Dirigibles.—The ship of the air must be preserved from contact with the ground just as carefully as the ship of the sea is prevented from touching bottom. The many cases in which airships have been wrecked when upon the ground proves that the only safe way to anchor an airship is to moor her head on to a lofty mooring mast or tower. She would then ride head-to-wind just as a ship rides head-to-sea when anchored.

Our Latest Dreadnought.—Our latest dreadnoughts —"Iowa" and "Massachusetts"—will mark a great advance in size and power over any previous warships. Their length will be 684 feet, their breadth 106 feet, and their mean draft will be 33 feet. The motive power will be similar to that of the "Mexico," that is to say they will have the electric drive. The maximum speed will be 23 knots and they will have a cruising radius of 8,000 miles. Their displacement will reach the unprecedented figure of 43,200 tons. The armament will consist of 12 16-inch guns and 16 6-inch guns.

Fuel Oil Economy.—As showing the advantage of oil fuel in merchant ships, A. P. Allen of the Shipping Board draws attention to the increased cargo-carrying capacity resulting from the substitution of oil for coal. Thus, in a 10,000-ton deadweight ship, the increase is 800 tons of cargo on a 7,000-mile voyage, which at $50 a ton means a saving of $40,000. Deducting from this the higher cost of the oil over coal of $3,500, there is an advantage of $37,500 over a coal-burning ship, which is sufficient to pay for all the fuel used on over two and one-half voyages.

Artillery Ammunition Returned from France.—According to the *Army and Navy Journal*, the artillery ammunition received in the United States from France from the signing of the armistice to March 31st includes the following: 75 mm. shrapnel, 2,839,500 rounds; 75 mm. H. E. shell, 924,153 rounds; larger calibers, 311,823 rounds. Figures summarizing these returns by tonnage are not yet available for recent months, but the total returned during January amounted to 40,444 short tons, excluding French replacement steel. Of this total 35,177 tons were artillery and small arms ammunition.

The League Would Rule the Sea.—Commenting on the suggested necessity for at least one naval power included in the League of Nations to possess a fleet equal to that of Great Britain, a writer in the *London Times* shows that with the League of Nations against her Great Britain could never preserve communication with her dominions. It took 50 British and Allied cruisers to round up a dozen German cruisers which had no bases to fall back upon; but in a war with the League, scores of fast warships based upon widely distributed and defended ports, could paralyze the overseas commerce of Great Britain and starve the islands into surrender.

Army Ordnance Policy.—The plans of the Chief of Ordnance for the manufacture of ordnance material are based upon the probable requirements of ordnance under any future emergency. Facilities for the production of guns and recuperators will be maintained to a capacity ample to meet future requirements; but very small facilities will be maintained for the manufacture of gun carriages and gun forgings, since these can be obtained by rapid modification of existing commercial plants without any serious delay. A body of skilled men will be maintained at the government arsenals, who in case of emergency can be distributed among commercial plants.

The "Bulge" as Torpedo Protection.—During the war a favorite suggestion of inventors for the protection of ships against the torpedo, was the towing of nets or plates 15 or 20 feet from the side of a ship, said protection being generally suspended from the ship itself by means of booms and ties. The "bulge" or "blister" which proved so successful on the monitors is really an application of this idea. Separate plates, it was found, could not be held in place, especially in heavy weather; but in the "blister" the plating is brought in at the top and bottom and merged with the structure of the hull into one integral whole. According to British designers, if the "bulge" forms part of the original design, there is no serious loss of speed.

Science

Dr. Hamilton Rice, of Boston, who has had many thrilling experiences in far-away lands, starts this month on his sixth journey of exploration in South America. He has built a 45-foot launch for navigating the shallow waters of the upper Amazon. The vessel, which contains living quarters and a laboratory, has a draught of only 20 inches.

Temperatures of Pavements in Hot Weather.—The "hot pavement" which figures in the typical description of city weather in the dog-days deserves its bad reputation, according to an article by Mr. G. S. Eaton, in the *Engineering News-Record*, reporting the results of thermometric readings made on August 6th and 7th at Riverside, 20 miles from Chicago. Readings were taken every half hour from 8 A. M. to 10 P. M. at the surface of three types of pavement; also one foot and four feet above the pavements, and over adjacent lawns. Maximum temperatures of 124, 118 and 114 degrees Fahr. were attained respectively by asphalt, brick and concrete surfaces. From 11 A. M. to 6.30 P. M. the average temperatures of these three types of pavement were, respectively, 118, 113 and 108 degrees. The writer points out that the trouble caused to motorists by the expansion of air in rubber tires in hot weather must be greatly aggravated by these pavement temperatures, while the effects on horse's hoofs and on shoe leather are problematical. During the middle of the day the air one foot and four feet above the roadways was from 3½ to 4½ degrees higher than over a lawn in the sun. On the same days the Chicago station of the Weather Bureau recorded the highest daily maxima for the summer; viz., 102 and 101 degrees.

Studies of Fog-Signal Machinery.—In a pamphlet recently issued by the Honorary Advisory Council for Scientific and Industrial Research, in Canada, Prof. Louis V. King, of McGill University, presents a preliminary report on the extremely valuable investigations which he has been carrying on for some years in regard to the operation and efficiency of fog-signals. The type of fog-signal most favored by the Canadian authorities is a modified form of compressed-air siren known as the "diaphone." Although a great many experiments have been made with apparatus of this character, actual measurements of the sound at various distances from the siren and under various conditions had been lacking until such measurements were made by Professor King at Father Point, Quebec, in 1913, with the aid of a "phonometer," devised by Prof. A. G. Webster, of Clark University. A large amount of new information was thus obtained concerning the behavior of sound in relation to meteorological factors, especially wind, including the occurrence of the well-known "silent zones," which have been responsible for many marine disasters. Professor King also devised a method of testing the "acoustic efficiency" of the siren; i. e., the actual proportion of power converted into sound. It was found that under normal conditions the output of sound was only about eight per cent of that which would be emitted from an ideal siren in which all the energy of the compressed air was utilized in the production of acoustic signals. After an interruption due to the war, experiments were resumed in 1917. Acoustic surveys were carried out on a more elaborate scale, in conjunction with meteorological observations, including wind measurements at various altitudes made with pilot balloons. A new line of research was also begun; viz., a study of the quality of the signals given out by the diaphone. Prof. Dayton C. Miller, of the Case School of Applied Science, joined the party at Father Point, bringing with him his ingenious "phonodeik," which makes a photographic record of sound waves, and enables an accurate analysis to be made of the purity of the sound; i. e., the relative proportions of acoustic energy contained in the fundamental and the overtones. The discovery was made that the high overtones produced by the siren do not travel far through the atmosphere, and therefore represent a waste of energy. Hence in designing sirens the attempt should be made to concentrate all the energy, so far as possible, into the fundamental tone. Thanks to all these studies, it will now be possible to place the construction of fog-signals and of sirens in general, including those used on shipboard, on a truly scientific basis. It will also be possible to construct portable apparatus for use in testing fog-signals.

Automobile

Lubricant Testing Machine.—A device has been constructed by an automobile manufacturing firm in its own shop for testing the properties of lubricants. The machine is built on the following lines: The chief part is a pendulum hung on a bearing which is supported on a shaft rotated by means of a pulley. The bearing is composed of two brasses to which pressure can be applied by a spiral spring inside of the pendulum. The pressure regulation is effected by a milled-head screw. When the shaft is rotated the friction between it and the brasses causes the pendulum to set itself a certain number of degrees out of the vertical and this distance together with the pressure on the journal give an indication of the friction, from which the friction-reducing value of the lubricant between the shaft and bearing can be determined by consulting a calibrated scale.

Meaning of Piston Speed.—The factor that limits the piston stroke and makes the speed of rotation so dependent upon the travel of the piston is piston speed. Heretofore it has been considered desirable not to exceed a speed of 1,000 feet per minute, which has been determined to make for greatest efficiency, combined with endurance, by many authorities on design and construction of internal combustion motors. During the past few years there have been instances of engines that were giving satisfactory service with piston speeds of 1,200 to 1,500 feet per minute, and in some automobile and aviation engines the piston speed may attain values of 3,000 feet per minute without power losses due to undue increase of internal friction. Lubrication is now the main factor that determines piston speed, and the higher the rate of piston travel the greater the care that must be taken to insure proper oiling.

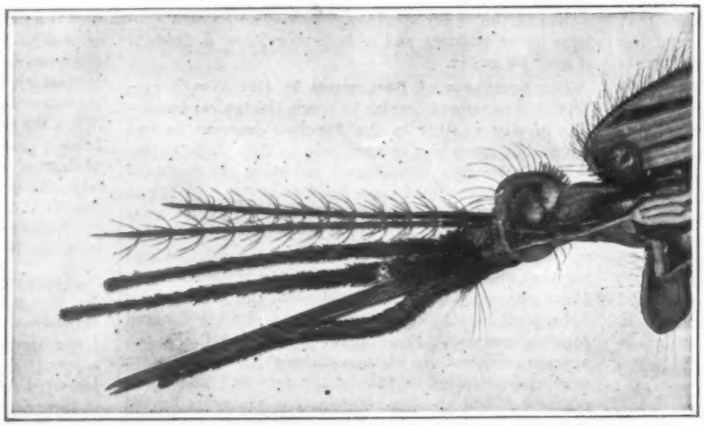
Valve Operating System Depreciation.—The only remedy for wear at the various hinges and bearing pins is to bore the holes out slightly larger and to fit new hardened steel pins of larger diameter. Depreciation between the valve plunger guide and the valve plunger is usually remedied by fitting new plunger guides in place of the worn ones. If there is sufficient stock in the plunger guide casting, as is always the case when these members are not separable from the cylinder casting, the guide may be bored out and bushed with a light bronze bushing. A common cause of irregular engine operation is due to a sticking valve. This may be due to a bent valve stem, a weak or broken valve spring or an accumulation of burnt or gummed oil between the valve stem and the valve stem guide. In order to prevent this the valve stem must be smoothed with fine emery cloth and no burrs or shoulders allowed to remain on it and the stem must also be straight and at right angles to the valve head. If the spring is weak it may be strengthened in some cases by stretching it out so that a larger space will exist between the coils. Obviously if a spring is broken the only remedy is replacement of the defective member.

Optimistic Trade Reports.—The success that has attended every automobile show held in the country has created great optimism in the automobile trade. The ban placed on production by the government prevented any accumulation of cars and because of the scarcity of automobiles, the increasing demand, even though many prospective car owners and drivers are still in the service, is so large that no difficulty is experienced in selling automobiles. During the war, the men handling motor cars had a hard time, as there was a shortage of expert labor that made giving adequate service out of the question. Many people who buy new cars annually, retained their old machines last year and as a consequence are in the market this season. The accessory business is also showing signs of improvement. This is especially true of the tire trade as the past open winter kept many cars in use in the Northern and Eastern States that would ordinarily have been stored for the severe winter weather, so a much larger number of tires wore out than would have been the case under normal conditions. There seems to be no immediate prospect of a drop in prices as the present supply of cars and their components will not keep up with the demand. The opinion of those familiar with the trade is that there will be considerable revision of prices when the cars for the 1920 season are offered and considerably more competition than now exists will be noted at that time.

The Carrier of Malaria

Museum Models Which Reveal the Structure of Anopheles Maculipennis

THE malaria mosquito, though no new problem, constitutes an ever recurring one. Every summer we have this pest with us, and every summer we are obliged to wage all over again the war upon him. This year the subject deserves, and is in fact receiving, more than the usual attention. While we have so many of our soldiers in the camps we are confronted with a series of artificial and highly concentrated seats of possible infection, in which the conditions of living, while subject to the closest control, are very far from those of ordinary civilized existence, and therefore likely to lead to all sorts of sanitary troubles, despite that control. At the same time we are putting forward a project to grant unoccupied lands to our returned soldiers which involves considerable danger. Such land as is available for this purpose is of necessity land which has not heretofore paid the cost of reclamation. This necessarily means that it is land on or about which there is an undue preponderance of water. The resident of Florida or the Mississippi Valley may be sufficiently acclimated to survive the conditions which surround him; the man from New England or the Northwest, suddenly and without preparation set down in these conditions, must inevitably succumb.



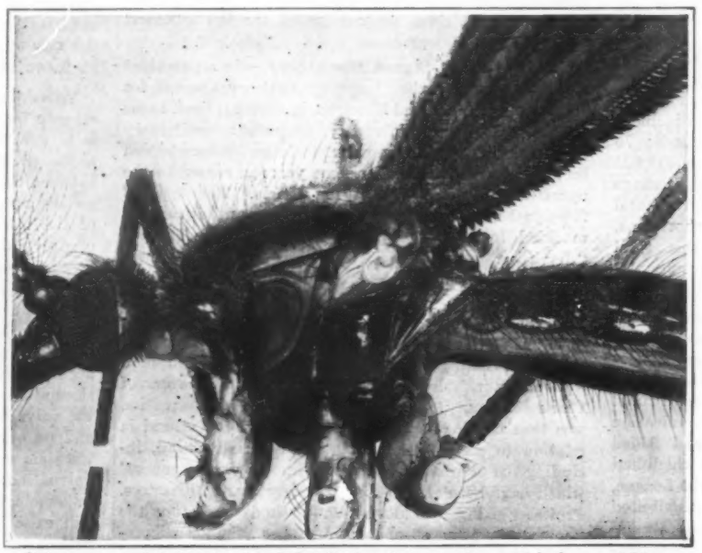
Head structure of the female mosquito, which does all the damage in connection with malaria propagation

The scourge of malaria is as old as history itself. As early as the fourth century B. C. there are indications which are now accepted as authentic of malaria epidemics; the disease is conceded to have been a potent cause, if not the dominating cause, in the decline of the Greek civilization. The ancients could not combat this unseen foe, because they were ignorant of its nature. As the name indicates, they imagined that the attack came from the air—preferably from the night air, which their fancy endowed with all sorts of evil qualities. It was not until 1897, through the discoveries of Ross and others, that the life history of the malaria parasite became known; and of course even now the old ideas prevail in many uninformed quarters. With our present fund of knowledge, intelligent defense against malaria is feasible; and this year of all years, when so much is dependent upon the health and working efficiency of the nation, the subject is being given particular attention.

Malaria is transmitted by certain members of the mosquito family. Since this discovery was made, mosquitoes in general have received a good deal more attention than before, and new species are constantly being found. Although the insect in question is a tropical one, it is by no means confined to the tropics, some 40 different species having been identified in the United States alone. They range as far north as the Arctic Circle; and in Alaska, Greenland and on the tundras of Siberia, where other insect life is scarce, they constitute a terrible scourge. Explorers tell tales of the mosquitoes on the snows of the Far North which make the misdeeds of the Jersey variety seem tame in comparison.

Mosquitoes in general are good travelers, though possessing little power of self-locomotion or even of self-direction. Like the old-style balloons, they go when and where the wind listeth; and, with a mild and favorable breeze, they will migrate to 35 or 40 miles distance from their breeding places. They vary in size from one-sixteenth inch to the huge Jersey "Gallinippers" of half an inch.

While any old kind of mosquito is a nuisance to have about the place, it is fortunate that they are not all pathogenic. In fact, of the 40 American varieties, the only one which has been convicted of evil practice in the matter of carrying diseases germs is *Anopheles Maculipennis*, or the spotted-wing mosquito. The present discussion will therefore be confined to this species.



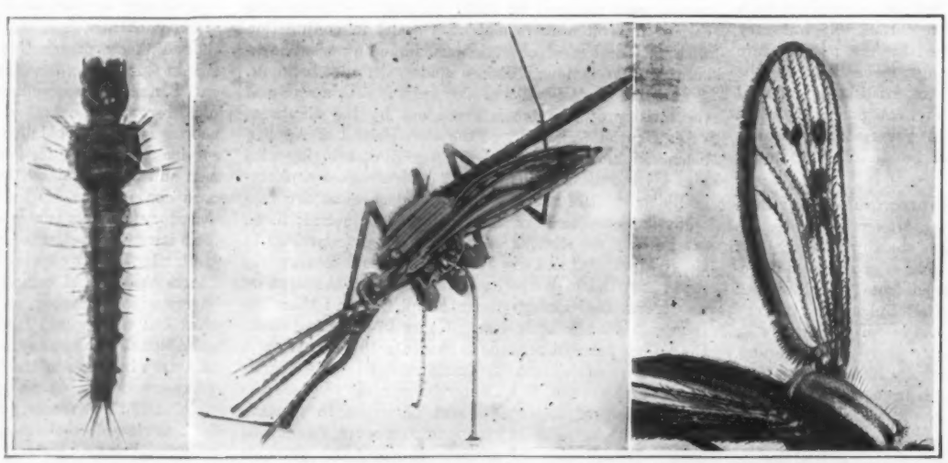
Museum model showing head detail of male mosquito, which does not bite or suck blood

Mr. Mosquito does not bite; his bill is so blunt that he could not be a blood-sucker if he wished. It is Mrs. Mosquito who does all the deadly work of fever propagation. She is most active around dawn and after sunset. She avoids strong light and prefers dark colors. She is essentially a domestic creature, staying around houses by preference. In the autumn the males die, and the females seek winter quarters. They hibernate in dark corners of cellar and garret, and on the first warm day of spring are out laying their eggs. Save when extended by the arrival of this hibernating period, the life of the female is one or two months; the male, on the other hand, lives but a few days. The food of the mosquito is the juice and nectar of plants, and of course blood—though not necessarily that of man; animals, reptiles, and even caterpillars are bitten with the same freedom.

The female mosquito lays from 50 to 100 eggs at a time, on any quiet bit of water. In about three days they hatch, and though at first the lava is very small, it grows rapidly and attains full development in a few days. We have then the familiar wrigglers of the old-time rain-barrel and the uncovered cistern.

In this stage the larva must have air, which it breathes through a siphon tube located near its tail. The normal position of the little animal is just below the surface, with tail pointing upward. It is at this time that the presence of an oil film over the water of habitation is fatal to the young mosquito; the oil clogs the siphon and the larva suffocates. This is by all odds the simplest and most effective way of destroying mosquitoes. It is simple because the problem of locating the pests is an elementary one; it is effective for the same reason that prolonged immersion in water is an effective way of destroying a man.

During the larval stage, which lasts from seven to 14 days, the malarial variety can be distinguished from all others, by the curiously inclined, by virtue of the fact that it lies with its body parallel to the surface of the water, while the other species hang with their heads downward. When the larva is ready to graduate, a T-shaped crack appears in the skin of the back, from which the pupa emerges. The pupa remains in the water, but does not eat. It represents the period of growth during which the internal changes begun in the larva are carried to completion, resulting in the adult mosquito. The most critical moment in the the life of the mosquito is when it emerges from the pupa shell. As is the case with so many other insects at this stage, the wings are not hard or dry enough to fly at once, and the creature is easily upset and drowned. In this way the flow of tide-water into marshes where mosquitoes have bred kills great numbers of them.



Models of the malarial mosquito, showing a view of the larva from above, the adult female, and a detail of the wing

In the adult mosquito there are to be recognized three major parts: The head, the thorax to which are attached the wings and legs, and the abdomen. The head has two large compound eyes composed of several thousand simple eyes or facets. This enables the mosquito to see in all directions. In front of the jaws are two branch-like growths with 15 or 16 joints, and at each joint a whorl of fine hairs. These are the antennae, or organs of hearing. Beneath is the proboscis, or tool-box. First comes the

labrum, the mosquito's drill, a long implement with a groove on the under side through which the blood of its prey is sucked. Next comes the hypopharynx, a thin blade which can be closely applied to the under side of the labrum to form a closed channel for the passage of the sucked blood. The hypopharynx has a fine tubular channel of its own inside, and it is through this that the malarial spores enter the body of the host. At the two sides and below the labrum are two pairs of slender lancelike instruments with spear-head points. These also enter the wound and help to brace the mosquito's head while its owner is enjoying his meal. It is probable that they fill the additional purpose of making the blood flow more freely. Below all this is the flexible sheath which is longer than the rest of the outfit and serves to cover the various organs and protect them while not in use. On either side of the proboscis are the maxillary palps or organs of touch.

The body is composed of three rings, the middle one bearing the wings. The latter are so very thin and delicate that they practically refuse to make any impression on the photographic plate, save where they are reinforced by ribs covered with fine scales. The arrangement of these ribs varies with the species; in the malarial variety there are four black spots on each wing which give rise to the name maculipennis already mentioned.

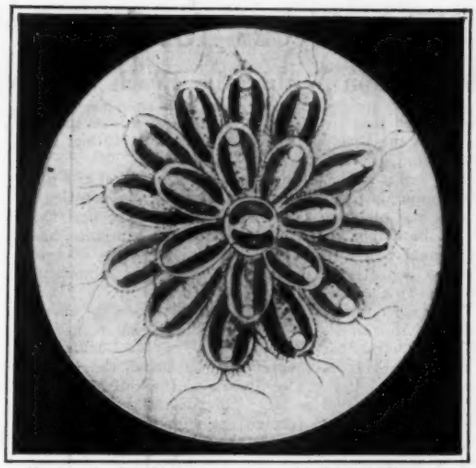
The legs are hollow tubes with the muscles inside. They are connected with the body by the coxel or hip-joint. This joint allows great flexibility of movement, and is altogether a very creditable bit of engineering design. The mosquito has three pairs of legs, of seven joints each. The hindermost pair is not employed in walking, as may be readily observed, but acts to balance the insect in flight and as an organ of touch. The mosquito has two pumps with which he extracts your blood; and when they both get under way you are relieved of a large drop of blood and inoculated with a goodly colony of malarial spores in less than a minute.

In view of the great timeliness of all discussion regarding the malarial mosquito and ways of meeting its ravages, the American Museum of Natural History has installed an exhibit consisting of large models of male and female maculipennis, together with the various stages in the development to the adult insect. It is from these models that the photographs shown herewith are taken.

Microscopic Organisms in Drinking Water

A RECENT experience of the water company that supplies the villages of North Tarrytown, Hastings, Dobbs Ferry, and Scarsdale, near New York, brings to mind the minute disturbers of the peace and well-being of the community, that may lurk in water apparently pure and underfiled.

During the past few months, the water furnished the consumers by this company had a very disagreeable taste and odor, particularly marked during October. Complaints came to the company so constantly, that they ordered an immediate investigation. The water from the tap was first examined and the microscope did not show the presence of any organism that would account for the peculiarly unpleasant taste and smell. As there was no abatement of the trouble, the investigation was extended to a study of the water in the reservoir itself, before it flowed out into the water pipes. Then the mystery was solved, for under the microscope there stood revealed the malign presence of the minute, one-celled animal known as *Synura*, not more than one one-hundredth of an inch in length. The reason it had not been discovered in water from the tap was immediately apparent to those knowing the habits and life history of this odoriferous little animal. Like other members of this group *Synura* lives in colonies. These colonies in the case of *Synura* are spherical in shape, and made up of about 50 individuals, loosely held together, each with a delicate membrane, often spiny with posterior stalk-like projections. The agitation of the water in passing from the reservoir to the filter plant broke up this loose, colonial organization, so that the tiny particles escaping into the flow of the faucet, though still malodorous and imparting to the water the characteristic taste, were yet too minute to show under the most powerful lens of the microscope. A weak solution of copper sulfate, harmless to man, was put into the reservoir, and in a few days, both odor and taste had entirely disappeared.

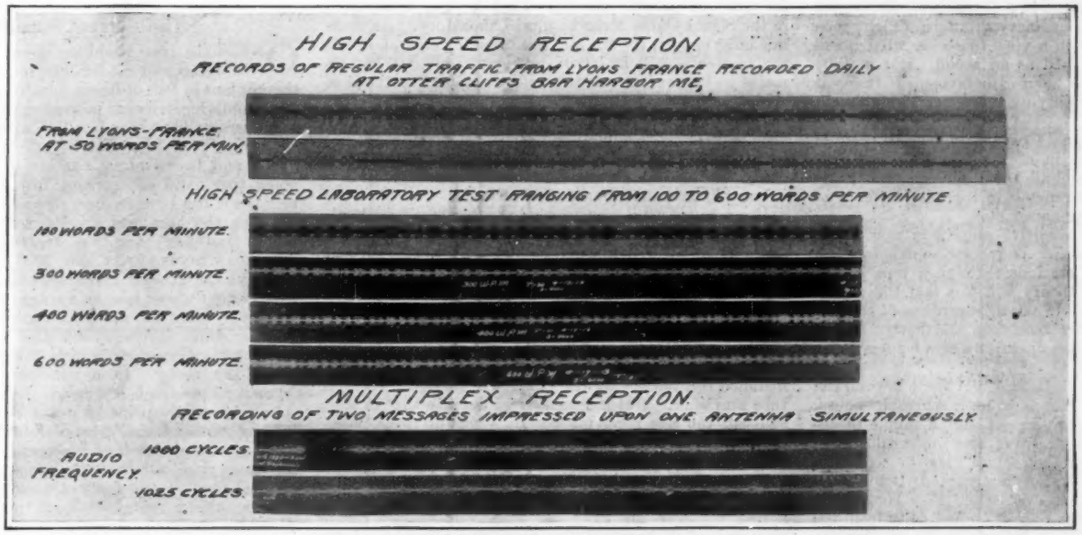


Synura in drinking water, magnified 1600 diameters

This recent experience with the water supply well illustrates the fact, that besides the larger forms of plant and animal life with which we are familiar, the clearest water may be teeming with minute microscopic forms invisible to the unaided eye. These may be bacteria carrying some deadly disease, or some noxious though less harmful form, or perchance some beautiful and perfectly harmless plant or animal. The balance and relation of these forms are of vital importance to public water supplies, for if there is a disturbed equilibrium so that any one of these organisms increases unduly in numbers, the water may become unsightly, ill smelling, and bad tasting. The flavor imparted by each of these various tiny organisms found in water is very characteristic. The *Synura*, found in the Tarrytown and Dobbs Ferry water supply, imparts a distinct cucumber-like taste; another, the *Asterionella*, gives a strong fishy flavor; *Aphanizomenon* causes a grassy taste; *Uroglena* imparts the unpalatable flavor of cod liver oil. Constant warfare upon these tiny troublesome foes which insist upon taking up their habitation in our drinking water, is the price of safety.—JOHN J. SCHOONOVEN.

Receiving Wireless Messages on a Paper Ribbon

PHOTOGRAPHIC receiving and recording of wireless messages as a matter of regular daily routine has been carried on by Naval engineers for some time past, at the Otter Cliffs receiving station near Bar Harbor, Me. For the purpose the engineers have made use of an instrument invented by G. A. Hoxie, an electrical engineer of Schenectady, N. Y. This radio invention permits the eye either to supplement or replace the ear in reading wireless messages; indeed, a totally deaf man could be a wireless receiving operator in a station so equipped.



Wireless recorder tape with signals made under different conditions and at speeds from 50 to 600 words per minute

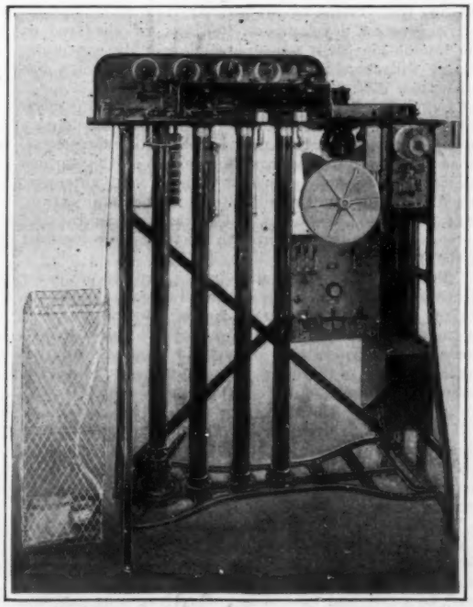
The photographic recorder, which is shown in the accompanying illustration, makes for greater speed in receiving, greater accuracy in deciphering, and provides a permanent record of every dot and dash in every message so received. Because of the very delicate tuning that can be obtained, and the resultant high degree of selectivity, it has been found practicable to receive messages despite many inductive noises and interfering signals which ordinarily have rendered reception impossible. Although the instrument is not immune from the effects of "static strays," it has successfully recorded messages at high speed regardless of strong static interferences that, without its aid, would have baffled the receiving operator.

It is stated that messages have been deciphered with its assistance, when operators were unable to get a single word of it by ear alone. From now on receivers do not hear by their ears alone. The photographic recorder supplements the usual method of receiving; and in that manner the outstanding obstacles to accuracy in wireless receiving have been eliminated, except for severe static interference.

The photographic receiver with its permanent record is a guard against error, and will settle any dispute; for its visual record of a message in dots and dashes distinctly shows to the eye what was received. A photographic print of this type is of unquestionable accuracy.

As to speed in receiving, this machine has frequently recorded at the rate of 400 words per minute; and more recently in a test conducted by Mr. Hoxie himself, the machine recorded a low-power message at 600 words per minute. Up to this time the most rapid method of recording radio signals has been by the phonograph, but this must still be transcribed by ear and not by the eye. Moreover, no permanent visual record is made. The phonographic method has never yet approached the rate of 600 words per minute, so the new instrument has hung up a new speed record, so to speak. An interesting sidelight on this feature of the invention is that high-

(Continued on page 638)



The high-speed photographic recorder recently tried out by the United States Navy

With Trees for Ears

A Wireless Station Within the Reach of Everybody

WITH a pair of receivers to his ears, an amazed visitor to a certain radio station heard a high-toned hum which changed to a low growl, then skied to the upper reaches of the musical scale in a faint, very faint buzz, as if some microscopic mosquito had had his song made audible. The operator rapidly turning the knobs on his couplers and condensers, raised his hand: suddenly, through the changing radio signals which were clamoring for attention together in the receivers came his voice; "There—the loud, easily heard one is New Brunswick; the fainter, lower one is Nauen, in Germany."

If all this had taken place in the great Arlington station one would not have wondered, save perhaps at the inability to tune out all radio but Nauen. But it was a little portable house erected in thick woods near the edge of the District of Columbia and the signals were received through an oak tree for an antenna.

It is not a joke nor a scientific curiosity, this strange discovery of Gen. George O. Squier, Chief Signal Officer, that trees—all trees, of all kinds and all heights, growing anywhere—are nature's own wireless towers and antennae combined. The matter first came to his attention in 1904, through the use of trees as grounds for Army buzzer and telegraph and telephone sets, which, in peculiarly dry ground and in a dry season, functioned poorly or not at all with ordinary grounds. Right then he began experiments with a view to seeing what possibilities, if any, the tree had as an aerial. But in 1904 radiotelegraphy was far more undeveloped than at present, and vacuum amplifying tubes were not thought of.

During the war the Signal Corps established a chain of special receiving stations in different localities to copy and record both enemy and allied radio messages. Some of these stations were instructed to test the efficiency of growing trees as receiving antennae.

With the remarkable sensitive amplifiers now available, it was not only possible to receive signals from all the principle European stations through a tree, but it has developed beyond a theory and to a fact that a tree is as good as any man-made aerial, regardless of the size or extent of the latter, for receiving, and better in the respect that it brings to the operator's ears far less static interference.

This is rather a broad statement, yet there beyond the Capital of the Nation stands a little portable house, the oak tree, a small receiving set and a couple of enlisted men and an officer on duty; and the curious may, with permission, hear for themselves that the signals so received are neither faint nor interrupted, but strong, full-toned dots and dashes even when they come from far-off Nauen. Page after page is copied daily from the propaganda material which Nauen sends out by the ream. Lyons, Poldhu, ships at sea, even the NC-4 on her way, are heard plainly. As for New Brunswick or nearby Arlington—they deafen the listener if he is unwise enough to try to "take" them otherwise than with the 'phones lying on the tables.

It will puzzle the amateur as it has puzzled the experts, how a tree, which is certainly well grounded, can also be an insulated aerial. The method of getting the disturbances in potential from tree top to instrument is so simple as to be almost laughable. One climbs a tree to two-thirds of its height, drives a nail a couple of inches into the tree, hangs a wire therefrom, and attaches the wire to the receiving apparatus as if it were a regular lead-in from a lofty copper or aluminum aerial. Apparently some of the etheric disturbances passing from tree top to ground through the tree are diverted through the wire—and the thermionic tube most efficiently does the rest.

It is interesting to learn that the tree behaves very much like any other aerial; it receives better in dry clear weather than in muggy, damp weather. It plucks messages from the ether more clearly at night than in the day. It is effected very little by rain. It is effected not at all by the presence of other trees; so far as has yet been ascertained it makes little difference whether one drives his nail in a tree in the forest or a lone tree on the plain. Certainly it makes no difference that amounts to anything whether the tree be just an ordinary tree or a giant; it was a 60-foot oak over which the very awe-struck correspondent heard Nauen telling a waiting world what good people the Germans really are. And to prove that it made no particular difference what kind of a tree was used the officer in charge switched to a pine tree, which received equally well.

A dead tree will not do, and a tree not in leaf is not so sensitive as one in full foliage. It makes much difference where the nail is driven. General Squier calls the proper place the optimum point, and experimentally it has been determined that two-thirds of the distance from ground to top is the best place—in a 60-foot tree, 40 feet from the ground.

One nail is sufficient, and it may be any kind of a nail; but copper is preferred as not rusting. In practice, if a tree station is to be at all permanent, several nails would be driven and connected to the same wire, each additional nail up to six or eight making the diverted current a little stronger. But 40 nails apparently produce no clearer signals than half a dozen.

The tree may serve as a receiving station for several sets, either connected in series with the same material or from separate terminals.

Some skeptics have expressed the belief that it was not the tree, but the wire leading to the nail in the tree which was the real aerial. The absurdity of thinking a 40-foot wire could receive the widely differing wave lengths which come through the tree station is obvious, but to set any doubt at rest, the wire to the tree has been hung to the nail by means of an insulator, when the signals immediately cease, only to come in as strong as ever just as soon as the connection is again established.

Just what the tree will do as a transmitting station for radio telegraphic messages has not been determined in the Signal Corps Experimental Laboratory. As those in charge express it "the fact has been demonstrated, but the matter is still in laboratory stage only. What remains to be done now is to develop the best methods of using the demonstrated fact."

But it has already been shown that the tree can be used in wireless telephony and for short distances it has been shown that two-way telephonic communication is easily established through trees with remarkably low values of transmitting antennae current.

If a tree may be used to send out wireless telephonic waves it seems not unreasonable to suppose that it will do so as easily with the telegraphic waves. At present the Signal Corps is at work on apparatus to test the possibilities of the tree as a transmitting station.

Just what this development of the art of radio telegraphy may mean has not yet been worked out. It is the history of most discoveries that their potentialities are hardly dreamed of when they are first made—instance the telephone, the electro-magnet, the vacuum tube amplifier. But it seems fairly obvious that in war, at least, the tree receiving station opens up great possibilities.

True enough there are few trees which remain intact under shell fire, and doubtless with this possibility in mind the armies of the future (if there be such) will in action consider all trees as dangerous enemy aerial stations. But there will always be trees behind the lines and not all actions will be fought on bare ground. What would it have meant to the "lost battalion" to have had a tree wireless set along by which it could have heard that every effort was being made to find and relieve it, or by which it might have sent back messages supplementing that carried by the pigeon?

The greatest development, however, of the tree as the foundation for a receiving and possibly a sending station will come in peace uses. General Squier has written:

"In view of what has been accomplished in space telegraphy, it is difficult to predict to what extent this means of communication may be ultimately developed. If, as indicated in these experiments, the earth's surface is already generously provided with efficient antennae, which we have but to utilize for such communication, even over short distances, it is a fascinating thought to dwell upon in connection with the future development of the transmission of intelligence.

"Since a transmitting station is a central point for electromagnetic waves sent out in all directions over the surface of the earth, a large class of information, such as meteorological reports, crop reports, and general news items of interest to all, may in time be sent from central points, to be received at many places within the radius of influence of the signal station, and this, too, by the simplest forms of apparatus."

The amateur wireless world will unquestionably take an intense interest in the tree radio work. At present, while the government has lifted the ban upon amateur aerials, it has not removed the strictures against sending.

The aerial is always the great problem for the amateur. Lack of both money and material prevents him erecting anything very large or of very great capacity. If any lad with a receiving set and some thermionic tubes can hook to a tree and take in any wave length he can tune to, will not tree radio vastly increase the devotees of this particular variety of indoor sport? The matter is one of some importance, inasmuch as many valuable recruits to the radio world have come from amateur ranks, and many a radio engineer got his first taste for the fascinating art through a home-made tuning coil and detector, under the attic roof. The greater the amateur wireless world, the quicker the development of the art as a whole.

Explorers, discoverers, engineers in far places, the forest service, the woodsman, all have use for the new development. Moreover the tree as an antenna offers unusual possibilities for the investigation of atmospheric electricity phenomena and for what may be called the physics of botany (or the botany of physics) and perhaps is the road by which the unsolved puzzle of growth may be studied.

Meanwhile, it is a thought not without great power to move the sensitive imagination that every tree, growing everywhere, is a wireless tower and antenna and that, as General Squier says, "it is significant that a tree, possessing utility and natural strength, architectural beauty of design and endurance far superior to artificial structures prepared by man, should be able yet further to minister to his needs."

The Current Supplement

ONE of the great problems of our lumber merchants is the cheap and moderately speedy transportation of the millions of feet of uncut logs from their native forests to the mills located near power-centers or lumber markets. For years we have been familiar with the gigantic, cigar-shaped rafts of logs chained into a more or less stable whole and towed along our coasts by powerful ocean-going tugs. An enterprising firm on the Pacific Coast believes it has improved on this method and proposes to combine the logs into a solid wooden boat driven by power and sail, and the frontispiece to SCIENTIFIC AMERICAN SUPPLEMENT, No. 2267, for June 14th, 1919, portrays the general appearance and plan of this novel type of boat whose maiden voyage will always be her last. Of recent years sulfuric acid has become even more important than lumber, and the readable account of *Making the Universal Reagent* will undoubtedly be welcomed by many. In a valuable address Prof. J. J. Thomson recently discussed *Spectrum Analysis and Atomic Structure* pointing out a remarkable application of the quantum theory, here presented in a condensed form without mathematical expressions. An entertaining and ingenious application of the selenium cell and solenoids is illustrated in the form of an obedient *Electric Dog;* while another inventor sets forth the value of his *Abrasion Meter* to users of abrasive wheels, enabling them to determine the peculiar advantages of each type for different kinds of work. Much work has been done at different times by different men on the *Color of Water,* but the material is widely scattered and sometimes out of reach, we therefore welcome a very full compilation on this subject. The instructive study of *The Races of Russia,* and the well-illustrated series on *The Shell-Builders* are brought to a close. Shorter articles deal with the *Influence of Magnetic Field on the Initial Phase* of a discharge; *Unique Prehistoric Pottery* of the pueblo type; an illustrated description of *Eredia's Dew Gage* (*Drosometer*). and an interesting apparent contradiction of theory concerning the arrangement of pulleys for lifting weights in *Theory vs. Practice.*

Demobilizing Shells

IF the full particulars of the amount of shells existing in the various warring nations' shell plants and shell dumps were available, the total tonnage would run, doubtless, to amazing figures. Except for such stocks as are normally maintained by the various military powers, nearly the whole of this vast total consists of material that can have no immediate use, and, if our hopes are realized will have no use for generations to come. But shells are made of good steel and considered as steel they afford a vast supply of raw material for the melting furnace and the steel mill.

The first thing to be done, of course, is the removal from the shells of the copper driving bands which, of course, have high value, and of the explosives with which the shells are filled. After this has been done, the shells are loaded into railway trucks, taken to the steel works and there, as in the case of the plant which is illustrated on the cover of this issue, they are unloaded and dumped on to the scrap heap by means of magnetic cranes. Our drawing is based upon one in *Illustrated London News,* representing a huge shell dump being formed in the scrap yard of a German steel plant.

Invention as the Foundation of the Nation's Wealth

Exhibition of the Interior Department Which Emphasizes This Side of the Work of the Patent Office

By C. H. Claudy, Washington Correspondent of the Scientific American

THE Interior Department has just held a most educational exhibition in the main corridors of its great new building in Washington. Here were gathered together exhibits from all the various offices and bureaus which collectively form the Department of the Interior, to exemplify and explain its work. The exhibits ranged all the way from the work of the students at Howard University and the handicraft of the wards of the Indian Office, to working models of mine apparatus arranged by the Bureau of Mines and a most elaborate exhibit from the Patent Office.

To the general public, the interest in the patent office exhibit centered around the Liberty Motor, the automatic telephone exchange and the collection of models, historic and interesting; but he who gave time to the documentary exhibits on the walls could find much food for thought. Three tables really summarized the work of the Patent Office as one of the main foundations of American wealth. And it is most pleasant for the Washington Correspondent of the oldest scientific journal in the nation to chronicle that the SCIENTIFIC AMERICAN was here quoted as authority for statements made regarding inventions.

The first quotation appears in Table No. 1, which is titled "Forty greatest inventions of modern times selected from the estimates of 45 primary examiners and from lists printed in the SCIENTIFIC AMERICAN."

These 40 greatest inventions of modern times are credited to six nations—America, Great Britain, France, Germany, Italy and Norway. Most of them are attributed to one nation in their entirety, but a few are laid to two nations jointly. Great Britain is credited with being responsible for the steam engine, the Bessemer process, analine dyes, the steam turbine, the locomotive, the hot blast for blast furnaces, the spinning jenny, half of the open hearth process, the cyanide process, the rotary printing press and half of the regenerative furnace.

Germany gets credit for the other half of the regenerative furnace, the gas engine, the Diesel motor, the by-product coke oven and the X-ray. France is hailed as the home of photography, the Jaquard loom, artificial refrigeration, and parts of the development of the open hearth process and of aluminum. Italy, of course, is credited with wireless and Norway with half of the work necessary to develop the fixation of nitrogen.

Then comes the American list, starting with the cotton gin, the reaper, telegraphy, vulcanized rubber, the sewing machine, the airbrake, the telephone, the incandescent light, half the work of aluminum, the induction motor, the airplane, the kinetoscope (foundation of the moving picture industry), the linotype, the steamboat, electric welding, high-speed steel, half the labor in connection with the fixation of nitrogen, the typewriter, the phonograph, the trolley car, and the Cottrell precipitation process.

Another table lists the "ten greatest inventions of the last quarter century as determined in the SCIENTIFIC AMERICAN contest." These are the electric furnace (France and America), the steam turbine (Britain), the automobile (France and Germany), the moving picture (America), the airplane (America), wireless (Italy), the cyanide process (Britain), the induction motor (America), the linotype (America), and electric welding (America) by which it is seen that this country gets credit for more than half of the 10 greatest modern inventions, against the rest of the world.

A third table lists the 10 most radical inventions, as determined by the Assistant Commissioner of Patents, Mr. Clay, from estimates made by the various examiners. These are the steam engine, printing, the sewing machine, the telegraph, the gas engine, the phonograph, wireless, the airplane, the kinetoscope, and photography; and one-half of these are pure American in origin.

To date, so the exhibition shows, we have issued over a million and a quarter patents. More of these have been issued in the past 20 years than in the previous 105 years. And of these million and a quarter, almost all are on improvements, adaptations, rearrangement—very, very few are what are known as basic or pioneer patents. For instance, had there been patents at the time Gutenberg lived, any he took out on the making and use of movable type would have been pioneer patents. But the type-setting machine patents are none of them truly basic, since they are all on the adaptation of known mechanical movements to produce something which is already known and otherwise produced. But Marconi, when he took out his patent on July 13th, 1897, obtained a pioneer patent, since it was the foundation of what has since become a great industry and an integral part of the fabric of civilization.

In the patent office exhibit were shown 30 pioneer patents. One takes off one's hat to the diplomacy of the patent office officials for the way they have dodged one or two burning questions as to who is really responsible for some of the great inventions of history. For instance: Wright is represented by his patent of March 22d, 1906, for a "flying machine," Curtiss by his patent of October 12th, 1915, on the "hydroplane" and Montgomery by his patent of September 18th, 1906, for an "airplane."

Phillips is credited with a one-man power submarine (1852), Tuck with a submarine-placing torpedo (1884), Lake with a submarine (1896), and Holland with a submarine (1902). Other pioneer patents exhibited were those of de Forrest, which resulted in the amplifier, that modern wizard of electricity which makes easy so many otherwise impossible things, like long distance wireless telephony; Fleming, current rectifier; Edison, incandescent lamp, "speaking machine," speaking telegraph and telephone; Berliner, microphone and gramophone; Balke, telephone transmitter; Westinghouse, triple valve on airbrake; Bell, the telephone; Morse, telegraph signs; Peck, corn harvester; Unge, aerial torpedo; Robinson, track circuit for block signals; Hewitt, mercury vapor lamp; Husey, the first reaper patent which shows the cutter bars and knives (1833); Van

(Continued on page 640)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Puffed-Brick Ships

To the Editor of the SCIENTIFIC AMERICAN:

It was with a great deal of surprise and disappointment that we read in the SCIENTIFIC AMERICAN of a recent issue an article describing two puffed-brick ships which are "soon to be launched at San Francisco."

For the information of yourself, permit us to point out that these ships are being constructed not in San Francisco but in Oakland, at a point about nine miles distant from the former city.

This error is felt the more keenly in Oakland because we were at special pains to locate one of the Government concrete ship-building yards here and it involved months of negotiation and the expenditure of a large amount of energy in not only combating those opposed to us but also in straightening out legal and title tangles.

EUGENE BOWLES,
Secretary, Oakland Chamber of Commerce.

Oakland, Cal.

Future Aircraft

To the Editor of the SCIENTIFIC AMERICAN:

Reading Mr. d'Orcy's interesting article, "Airship Versus Airplane" in SCIENTIFIC AMERICAN of February 1st, 1919, as a layman on the subject, I am tempted to divest myself of the following: Since Mr. d'Orcy has made it clear that the airship has inherent qualities not to be found in the airplane and vice versa, would it be presumptious to assume that a happy solution for the safe-air-navigation problem would be to combine the essentials of the two? Take the cigar-shaped dirigible illustrated on page 98, depicting the storage of this wonderful practically fire-proof helium gas; does it take a great stretch of the imagination to note the similarity this dirigible has to the fuselage of an airplane? Suppose the airplane fuselage were fitted with helium carrying chambers; or, to carry the idea further, an inner and outer skin containing helium within the walls. Wouldn't this give to the airplane such buoyancy that it could practically hover or carry more freight and passengers? But one may object on the ground that a fuselage prepared to carry this much sustaining gas would at once become disproportionate or much larger than the conventional size of fuselage. This, I hardly think so; since the inner part of fuselage, as they now are built, is not utilized for the most part for any purpose whatsoever. Further, other means of sustention could be supplemented by providing vertical air-screws or helicopters.

E. M. BLACKSHER.

Brewton, Ala.

The Langley-Manley Engine

To the Editor of the SCIENTIFIC AMERICAN:

In a letter appearing in your issue of November 30th, Mr. Elwood Haynes objects to a comparison of the Langley-Manley engine of 1901 with modern aircraft engines, claiming that "The power used was steam, and therefore limited in its enduring capacity to a few minutes."

While it is quite true that Langley did build some remarkable steam motors, nevertheless the particular motor referred to was not operated by steam, but was of the internal combustion type. It embodied such advanced engineering that it is properly considered a classic in the gasoline engine field and it seems strange that a man as closely identified with the development of the automobile industry as Mr. Haynes should not have been aware of its existence.

Many of its principal features have since been generally adopted, and it may be of interest at this time to note that the five radial cylinders were of seamless steel with cast iron liners, forged valve chambers, and brazed-on water jackets; that a novel arrangement of the connecting rods provided each of the five rods with a full bearing on the single throw crankshaft; and that the first really successful ignition system for multiple cylinder motors was devised, with a single coil and a high tension distributor, similar in many respects to the battery systems now so much in vogue. The Smithsonian Institution records several tests in which the motor developed an average of 52.4 horse-power for ten consecutive hours, and Mr. Manley, who was largely responsible for its design and construction, may be justly proud of his achievement.

Mr. Haynes is also very much mistaken in his estimate of the "enduring capacity" of the steam engine. He has probably forgotten for the moment that the real work of the world is being done by the steam engine, and that there are in operation today steam plants fitted with condensers and with improved engines and generators, that compare favorably in fuel and water economy, and excel in the matter of total weight and ability the very best internal combustion engines. In comparing the steam plant with the Rocket he is probably recalling how, in the early days, some steam machine has roared past him, only to stop a few miles further along to replenish its water supply at some convenient stream.

The possibilities of the modern steam power plant cannot be judged by the semi-experimental outfits of a decade ago. For it must be remembered that the same advances in all branches of engineering that have made the modern automobile possible are also available for the development of the steam plant.

W. D. BELL.

Columbus, Ohio.

Quinoa

To the Editor of the SCIENTIFIC AMERICAN:

I read in your issue November 23d, page 415, in a paper on "Substitute Bread":

"The Aztecs had a plant, 'the Quinoa,' which took the place of wheat. It is a grass and has tiny mustardlike seeds. Owing to the ravages of the Aphis it has entirely disappeared. But it made good bread and cakes."

Quinoa or *Quinua* is native to Peru and grows on the high slopes of the Andes, a region which we call *sierra*. Belongs to the family Chenopodiaceae, *Chenopodium Quinoa*, Willd.

Quinoa was cultivated by the Indians before the discovery of America; and it is actually largely cultivated for the sake of its seeds, which are a regular food on the sierra, and occasionally on the coast region ("costa"). Quinoa is boiled like rice and mixed with potatoes and some condiments; or roasted and ground and ate in this form.

So far as I know, Quinoa has never been used for flour or bread. Peru imports from Australia and other countries most of the wheat used on the coast region; and it would be a great thing for our country if Quinoa could be made into bread.

G. K.

Chiclayo, Peru, S. A.

For the Motor Tourist

What an Adequate System of Road and City Signboards Can Do for His Guidance

By Avis Gordon Vestal

IN an earlier issue of the SCIENTIFIC AMERICAN the Editors have permitted me to retail the results of my observations regarding the adequate blazing of the motor highway. The suggestions which I made there and the principles which I laid down had to do with but one aspect of the case. The tourist wants to know what road he is on, and he wants assurance that he will be able to stay on it till he reaches his destination; but he wants a good many things besides that. Some of these wants are more important than others; but I think if you will bear with me while I catalogue them you will agree with me that they are all worth meeting.

An interesting method adapted by a Kansas community of bringing out the historic interest of the Santa Fe Trail

In the first place, let me suggest that it is a wee bit egotistical for a town, and especially a small one, to take it for granted that all who enter it know where they are. That was all very well in the days when hay motors furnished the only means of road transportation, and when as a result the traffic consisted practically altogether of the neighbors. But now the speedy touring car takes people hundreds and thousands of miles from home. The sign at the outskirts of the village, "Slow down to umpty-ump miles per hour," shows that the inhabitants know the gas buggy is abroad in the land. Why not add the name of the town, with perhaps a word of greeting, as "Welcome to Hamilton"? I have driven through countless towns where the name was not to be found even over the post office! Of course one might sometimes make deductions from the signs over stores; but if these were always to be relied upon, there would be a good many more Bostons and Acmes scattered over the countryside than the map indicates. In my observation, the cities along the Lincoln Highway are particularly careful to introduce themselves to the stranger at their gates.

How to get into towns and out again, and some details as to the ultimate destination of the roads, are set forth on these signboards

It would not cost much to add a few pertinent facts of interest about the municipality. Some of the western cities indicate their altitude, which is of help in making carburetor adjustments. Others list their population; "1,200 live people, dead ones not counted," is a sign which I recall. A welcome statement is that of a free camp site or a public rest room. Where parks, museums, libraries, and points of scenic, historical or industrial interest exist these may well be named and directions given for finding them. The address of the local Automobile Club or Chamber of Commerce would be of interest to many strangers. The Detroit Auto Club, by posting a brief statement of local rules, has given concrete evidence of its realization that the traffic laws are not universally the same; but of course this would never do in the communities—happily growing less in number as well as in weight—which rely for ready cash upon the unconscious violator of some freak ordinance.

Signs promoting safety are more needful than numerous. Warnings of grade crossings are probably in the lead, yet are not at full efficiency. Other significant signs tell of sharp curves, of bridges out, of roads torn up for repairs. More often than not no warning is given of these temporary or permanent obstructions, and when notice does appear it is seldom supplemented by full details. Berkshire County, Mass., takes a medal here. It gives a diagram of dangerous curves and corners, large enough to be read on the fly; and it is scrupulous indeed in posting full directions for detours around road construction work. The mountain roads up T... ...n Canyon in Colorado and through the Yellowstone are also well posted for dangerous turns, while on a road leading to Denver's mountain parks we find mirrors set on the outside of blind turns.

Places of historic importance are worthy of memorializing when in sight from the road or easily accessible by side trips. At Pawnee Rock, Kansas, the motorist on the Santa Fe is told about the little state park, a few blocks away, where much of the early Indian fighting is commemorated. In New Ulm, Minnesota, there is a statue giving details of similar events. A stone marker tells the site of vanished Ft. Reno in Wyoming. At New Franklin, Mo., we found a central street monument designating the beginning of the historic trade route which was the origin of the Sante Fe. For many miles about New York this feature of the tourist's pleasure has been well attended to; perhaps Tarrytown is as conspicuous an example as any, with its old churches and its Sleepy Hollow and its Headless Horseman's Bridge.

Special boards with more detailed information about the route than the painted poles can convey should be more numerous. These should carry the name of the road, its termini, a replica of the pole symbols, mileage to the several large towns of the state, and a statement of any points of special interest. The tourist would be immeasurably aided in laying out his daily itinerary by such signs. Then it is especially important too that the point be well posted at which two roads diverge after following a common course.

The crossing of state lines and continental divides is always of interest; sometimes such points are well marked, more often one can only guess. The Lincoln Highway again deserves honorable mention here. Then, too, a picturesque waterfall or an odd rock formation is vastly more interesting if one knows its name. Riding through the superb Shoshone National Forest in Wyoming, I have found this feature exceptionally well looked after; through Yellowstone Park, too, the signboards name the rivers, passes, geysers and hot springs in profusion.

In arid lands, as those of the far southwest, a movement is well under way to mark the places where water may be obtained in the deserts. You can never know, until you ride through such a region, how water may be of more value than gold; for the human thirst is equalled by that of the motor. In a region both hot and high the water in the radiator boils away with incredible despatch. Where water exists far from habitations, it is desirable that the sign tell whether it is good only for cars or whether it may be drunk.

Map boards are often of service, not only to the tourist, but to the town which sets up the geography lesson. A very good one at Big Springs, Neb., signed by the Automobile Club of Southern California, outlines an "All-Year Route to the Pacific Coast." "Swing around by Des Moines" is a placard posted by the capital city on many main highways of the Buckeye State—and always with diagrammatic instructions how it may be done. In Nebraska several maps along the Lincoln Highway urge the motorist to take certain cuts. This way of securing his custom is much more graceful and more permanently useful than the rough-and-ready method of falsifying the painted poles to drag him through your town when he doesn't

Information about local traffic rules, spots of historic association, or danger points along the route, is always welcomed by the motorist

want to come. The City of Denver has in its municipal camp grounds a fine map of the motor roads into its mountain parks.

The most thoroughly and uniformly blazed paths are those having a well organized executive body with the perseverance and the "get-up" to solicit funds, the widsom to make adequate plans covering methods of marking, and a centralized expenditure of moneys. The newer or weaker highway associations have too often left the actual marking to be done by local labor and local money, confining the general efforts to the boosting of the work. The result has been little uniformity in the work and many weak or missing links where the local residents are too few in number or too poor to bear their share of the expense or too indifferent to undertake it when abundantly able. In states with sparse population, through which transcontinental routes must pass, it is really not fair to expect local funds entirely to support good roads and good-road markers for the benefit of non-contributing easterners. The reader has perhaps before now said to himself that all this fuss about marks is going to cost a lot of money, and that the tourist who asks for all the facilities which I have mentioned certainly demands a lot for nothing. I think I voice the feeling of the average tourist when I say that he would readily pay his share—that he realizes that he should pay for the highways he uses, whether they happen to lie in his state or not. Indeed, I look forward to the federalization of highways and highway marking, as well as of their surveying and proper surfacing.

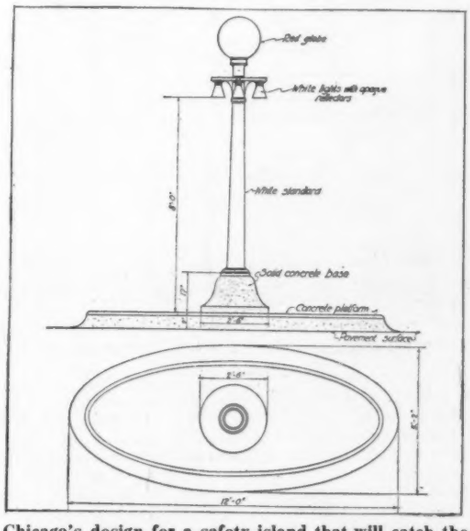
Until public sentiment shall crystallize for national road control there must be makeshifts. The most direct way for charging the user of a road, that of collecting tolls every few miles, has been rightfully repudiated in this country. It would by no means be unfair, however, to increase our state automobile license fees; in particular, while every state's license must continue good in neighboring states, it would not be unreasonable to ask the transcontinental tourist to contribute something in the way of a transient license fee to the states which he traverses. Then it ought to be possible to make a legal provision for the diversion of some small percentage of direct tax funds from cities, counties, townships, states or the nation for the marking of highways that are valuable for the many purposes of freighting, pleasure and business traffic.

As a concrete example of centralized work an official of the King of Trails, Winnipeg to Texas, writes that the painting of the poles on this route has been done entirely by one man under the direction of the National Association. It is paid for generally by the communities in which the work lies, but it is continuous and uniform whether or not any particular community has footed the bill. In doing a three-coat job, including several branches and alternative routes, but excluding certain stretches in Oklahoma not yet covered, the painter has put in about 2,250 miles of markers and has driven a total distance of more than 13,000 miles. He has been on the job for more than a year.

The National Old Trails, from coast to coast, is supplementing the pole markers with thousands of metal signboards. Upon each two-inch iron post, set in the proper location, are two galvanized iron signs. The upper one, 18 x 18 inches, is placed diagonally on the top of the post and designates the highway; this is identical on all posts. The lower one is set transversely; it is 18 x 24 inches, done in red, white and blue, and shows the mileage to the several neighboring and terminal cities. These special markers are found, on an average, once to the mile from Los Angeles east to Richmond, Ind., including some branches and loops. West of Kansas City the Automobile Club of Southern California coöperated largely with the National Old Trails Association in the labor and money costs. About 2,600 miles are thus posted, the aggregate cost being some $30,000; except in a few instances the cost was ultimately borne by the communities. This work was promoted early in 1914, begun in August of the same year, and finished during 1915. From Kansas City to St. Louis and from St. Louis to Richmond the work was promoted and done by the N. O. T. Association, at a cost of $6,000 for signs that average something less than a mile apart.

Similarly, while all the Lincoln Highway marking has not been done by the Association responsible for the Highway, the work that has been done has been at the direct motion of the Association, At the time of the dedication of this route in 1913, the various communities along the way established a more or less haphazard system of marking, quite lacking in uniformity. Three years later the Association sent two cars, manned by crews of two men each, across the country from New York to Sutherland, Neb., a distance of 1,750 miles. Eight thousand standard red, white and blue markers were painted upon the telephone poles of this section of the route. Working in conjunction with the ubiquitous Automobile Club of Southern California, the Highway was ornamented with permanent steel markers from Ely, Nev., to Salt Lake, late in the same year; and this summer, working with the same organization, the work will be carried on from Salt Lake east to Omaha. The Highway from Ely to San Francisco has been marked permanently by the California State Automobile Association. It is by such persistent action of the highway associations and the various local and general automobile bodies that adequate provision for the marking of all our routes must eventually be made.

The white posts stand out clearly; the two-colored globe is hardly satisfactory



Chicago's design for a safety island that will catch the speeding motorist's eye

Making Safety Islands Safe

TWO important purposes are served by the barriers known as safety islands—traffic is controlled and pedestrians are protected. On much traveled boulevards, lines of traffic are defined and congestion is minimized by safety islands at intersections. Every driver knows the path which will be followed by another car turning in or out or crossing; and reckless chauffeurs cannot pass over to the wrong side of the drive at these dangerous points of intersection with other streets.

Moreover, provision must be made so that pedestrians can stop at the center of the thoroughfare without danger of being run down. If all motor cars were well run, almost any easily seen signal would be sufficient to allow the pedestrian to pause in safety. But protection must be afforded against the recklessly driven automobile and the machine that is not under control. This makes necessary a substantial barrier, the base of which should extend well below the pavement surface. Otherwise the entire island may be misplaced when struck by a heavy car.

There is the temptation to assume that in any case where a car runs upon a safety island, the driver must be at fault. This is not necessarily the case; and the assumption that it is, is an unjust one. If a chauffeur cannot see a safety island he cannot be expected to avoid it. It is unfortunate that interest in these islands is too often dropped with their installation, so that seldom has much thought been given to making them really safe for motorists as well as for pedestrians. It has too often been overlooked that islands so shaped as to ward off vehicles striking glancing blows, and so illuminated as to be plainly visible, especially at night, are a prime necessity. If these are to be true islands of safety, rather than sources of danger, improvements must be made in their design which will cause them to be more plainly visible and as nearly collision-proof as possible.

At busy intersections one frequently finds lamp-post and globe broken, perhaps with an automobile stranded on the platform. While such a collision is frequently trivial, there is always the possibility of serious injury to the occupants of the car or of the island. Some idea of the frequency of these accidents may be gained from the number occurring at 153 islands under the jurisdiction of the South Park Commissioners in Chicago. A year's list contains 270 entries, ranging from mere breakage of the globe to complete demolition of globe, post, and even the platform itself.

Most accidents at safety islands occur at night. The red globe customary at these points furnishes but dim illumination, so that it may be impossible for the driver of a rapidly approaching automobile to see the extent of the platform. And, though a red light is visible at a considerable distance, on crowded streets the driver may fail entirely to see the danger signal, if the supporting post and the island base are nearly indistinguishable in the dark. Attempts have been made to gain better illumination by the use of two-color globes, red above and white beneath; but this scheme did not work out satisfactorily.

Adequate illumination of the base with white light is the needed remedy. Small lights placed just below the red globe, if shielded by reflectors open at the bottom, will make clear the size and shape of the platform without blinding the motorist. Greater visibility will also be secured by the use of white island posts. Black posts at safety islands were painted white last year by the two commissions having charge of the majority of parks and boulevards in Chicago. On the South Side both the lamp-post and the platform have been made white, while only the post has been painted at the islands under the jurisdiction of the Lincoln Park Commissioners. The platforms here, being of concrete, were judged to be sufficiently light-colored, and it was pointed out that on foggy days, when a dark object may be more easily seen than a light one, the red globe and the concrete base would furnish a color contrast with the pure white post.

What happens when the safety island is not properly visible

Concrete Data

A BULLETIN recently issued by the University of Texas shows how the compressive, tensile, and transverse strengths and other physical properties of dense concrete vary with the per cent of cement used in the preparation of the concrete; and thereby enables the designer and the builder of concrete structures to effect the greatest possible economy in the use of concrete by requiring the fine and coarse aggregate for the concrete to be mixed in such proportions as will secure a dense mixture, and adding only such a per cent of cement as is necessary to produce the strength or other physical properties desired in the concrete. This bulletin is for free distribution on application to Publications Committee, University of Texas, Austin, Texas.

The Wireless Incendiary

By Jacques Boyer

IN certain cases, radiotelegrams provoke fires from a distance This fact has recently been confirmed from the very interesting experiments of M. George A. Leroy. This chemist, as the result of several judicial examinations entrusted to him, in which the disastrous effects of fire could be attributed to no other cause than Hertzian waves, resolved to clear up the question in his Municipal Laboratory at Rouen. He revealed the misdeeds of the wireless by means of an apparatus which he has christened the igniting resonator, shown in our photograph.

This, as set up for M. Leroy's experiments, consists, first, of a glass bulb with four apertures, one at each of the four sides, as shown in the cut. Through each of the two lateral orifices passes an electrode of brass, and these electrodes carry micrometer screws which engage with cement nuts that form the interior surface of the holes in the glass. These electrodes are bored at their inner extremities to receive subsidiary electrodes of platinum, copper, iron, brass or carbon in various forms; while the outer ends are attached by means of a thumb-screw to a loop of copper wire from half a yard to a yard in diameter. In brief, M. Leroy has designed this system to be operated as a resonator of the classical Hertz type, but with the spark occurring in a closed vessel, in contact with various inflammable substances which are there submitted to test. The upper aperture in the vessel is closed by a stopper through which pass a manometer, a thermometer, and a drainage tube with a cock. Opposite it, the lower opening gives passage, through heavy packing, to a wire that supports, inside the vessel, a light table of mica on which are placed the inflammables for test; also to a second drainage tube with a cock, which meets the upper one already mentioned.

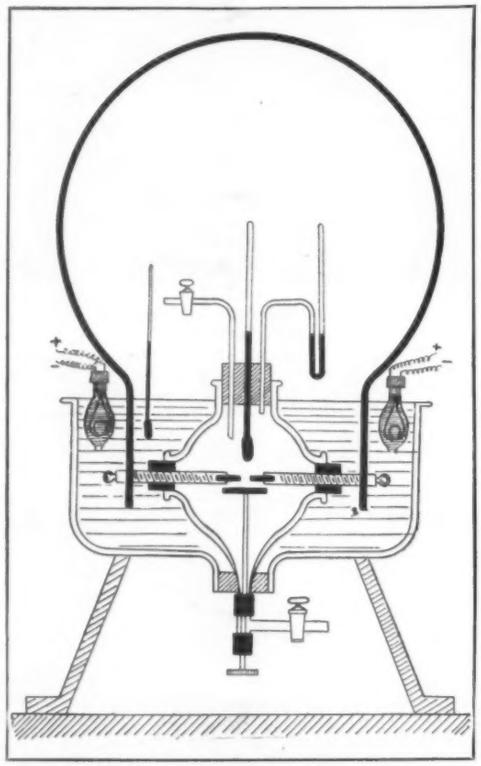
The entire bulb is immersed in a bath of oil of vaseline, itself enclosed in an inverted bell-vat. Heating is accomplished by aid of incandescent light-bulbs, the points of which are broken off after immersion in the oil. In this manner the internal vacuum of the bulbs draws in the oil, and the currents thus produced in the liquid enable the experimenter to vary the temperature of the test at his will. When it is necessary for this to exceed 50 degrees (Centigrade), the glass bell is replaced by a less fragile receptacle of zinc or brass.

On the other hand, the drainage tube communicates with the surrounding air, which is introduced into the bulb by an aspirator attached to the tube. Finally, since the good Rouenese chemist proposed to study the phenomena of slow oxidation and of latent combustion which can be manifested by certain substances, he evaluated these items according to the amounts of carbon dioxide liberated. It was, therefore, necessary for him to purify the air, and for this purpose he added to the experimental apparatus described above, tubes containing potash or soda and sulfuric acid or calcium chloride, in order to free the air at the beginning of all traces of carbon dioxide which it might contain. Then he passed the gaseous current that emerged from the bulb through several other vessels containing baryta water. The quantity of barium carbonate formed enabled him to estimate the intensity of the slow combustion.

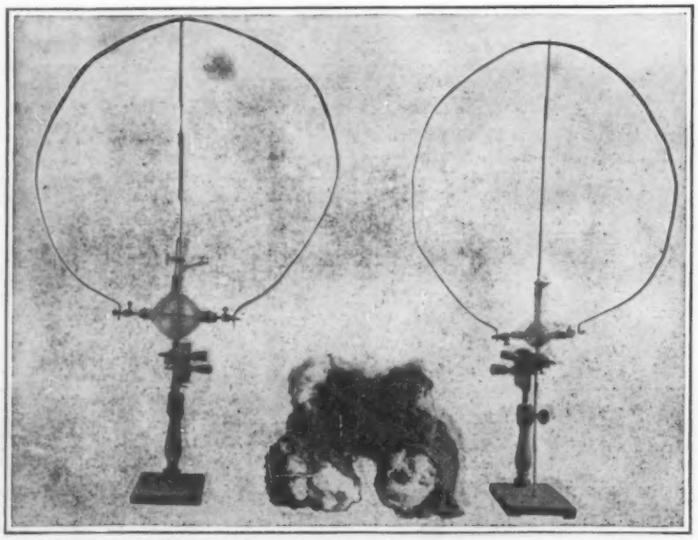
Once this igniting resonator was ready for action, M. Leroy projected upon it feeble Hertzian waves, producing these by means of an induction coil with a semi-liquid insulator injected in the vacuum. This transformer receives at the primary a maximum intensity of some 20 amperes, and gives a secondary spark of 45 or 50 cm.; it operates with continuous current from the city service, which is interrupted with a mercury jet interrupter. As condenser of the oscillating circuit, he utilizes simple sheets of window glass covered with tin foil, suspended vertically by means of glazed yarn, and presenting a quadruple armature of surface 1 meter by ½ meter. A large, flattened metallic wire and a double spiral of 50 cm. diameter constitute the transmission antennae, as shown in our photograph.

This rudimentary apparatus enables the skilled experimenter to show without doubt the incendiary action of the Hertzian waves, although their electric intensity is a minimum in comparison with the power of the large wireless stations now in service. In particular M. Leroy has set up at some meters distance inflammation of combustible materials such as guncotton, tinder, cotton, worsted, tow, paper, etc. For example, by his observations upon small bales of cotton enclosed in jute wrappers with iron bands, as this material is ordinarily packed for shipment, and of which one of our figures shows three in a pile, he explains in the following fashion the mechanism of so-called spontaneous combustion which at times bursts out in warehouses or on board ships.

In the course of handling, one of the hoops which encircles the bales of raw cotton breaks or comes loose under the action of shock or some other cause, and a small fragment of the metal projects in such way as to form a miniature Hertzian resonator. Then under the influence of the wireless waves sent out from some station, sparks pass and immediately inflame the covering of the cotton in their immediate vicinity. Equally, the contact between the metallic bands of the bales piled one on another in a car or packed in the hull of a boat, may establish an electric circuit offering the conditions of capacity and self-induction necessary for the production of the phenomena of resonance. In consequence, when the circuit finds itself interrupted by imperfect contact between two bales, incendiary sparks, apt to inflame the cotton, are likely to be produced.



General arrangement of the igniting resonator as set up for experiment



The igniting resonator by means of which the wireless waves have been convicted of incendiarism

The Locomotive of the Seas

THE ideal condition in any transportation business is when all carriers are loaded and in motion. This condition can seldom if ever be fully realized, but in accordance with the degree to which it is approximated dividends will go up and cost to the consumer will go down. The steam railroad is able to carry goods so cheaply over long hauls for the reason that single cars can be cut out of a long train and left on sidings to have a portion of their loads removed. If an entire freight train had to lay up at every station for which it carried goods, a transcontinental freight haul would be a lifelong undertaking.

The dealer in motor haulage has found himself confronted by the same state of affairs. It costs good money to have an expensive truck and its expensive driver laid out for an hour or two while loading or unloading or both are accomplished. The answer to this has been the trailer, and the development of procedures under which the truck is seldom or never loaded, but simply hauls trains of trailers; these it leaves to be loaded or unloaded while it goes on with another job of hauling.

This can be carried out more or less effectively wherever motor transport is practicable at all. But there is one field of transportation where the use of the train principle is limited—and that is on the water. On canals, in harbors, anywhere where smooth water can be guaranteed for the duration of a trip, a little tug can shunt a vast tonnage of freight from one place to another in barges, and go away for more while these are being unloaded. But in rough water towing becomes out of the question; so the train principle has never been applied to ocean traffic. Here we have the same old primitive conditions which would bankrupt a railroad in a week; every ship that carries ocean freight has to be idle, during a round trip, for precisely the time which it takes to load and unload her completely.

The problem of reducing what our French contemporary *Le Genie Civil* calls the period of immobility comes down, in last analysis to the separation of the propulsive unit from the carrying unit. Immobility on land is reduced to the minimum when the locomotive is divorced from the freight car and made a separate unit, or when the engine is divorced from the truck body and the trailer alone goes loaded. If the motor element is inseparably tied to the cargo-carrying element, it is obvious that when the latter is not in motion the former cannot be. It would therefore seem that the problem of reducing immobility at sea came right down to that of making the tow more universally usable, or that of making loading and discharging more nearly instantaneous. As a matter of fact, there is a middle ground, which is perhaps best illustrated by the Snell system developed in England. We give on our opening page diagrams of this system.

It is pointed out that the course taken by the efforts to maintain a merchant fleet in the face of submarine depredations has been such as to focus attention very strongly upon the conception of hull and machinery as separate entities, rather than as the single indivisible whole which they have always heretofore constituted. Delays in building ships have arisen almost entirely from trouble in getting the engines made and delivered. It has therefore been quite natural to get imbued with the idea that the engine does not necessarily have anything to do with the hull; and it is along this idea that the Snell system proceeds.

The propulsion of the ships built under this system is electric. In general the motor and the generator are separate installations. The latter consists of a Diesel engine or a steam turbine, coupled with an alternator. The propulsive group includes the helical propeller with shaft and reduction gears, driven by electric motor. The screws and electric motors ordinarily constitute part of the cargo-carrying hull; during a voyage they are connected up with the generating unit. This generating group is removable from one ship to another; it is taken out of one hull and put in place in another by means of floating docks of the ordinary type.

The removable mechanical portion of the ship goes under the very approrpriate name of the electromobile. It is put in place in the hull and firmly fixed there during a voyage. On arrival at port, the whole outfit goes into the floating dock. The electromobile is detached from the hull and fastened to the dock, without being shifted from its position; the dock is emptied, and as it rises it lifts the electromobile clear of the hull, so that the latter can float out from under. A new hull is slipped in, the dock filled, and the electro-

(Continued on page 640)

Southern California's Burning Canyon

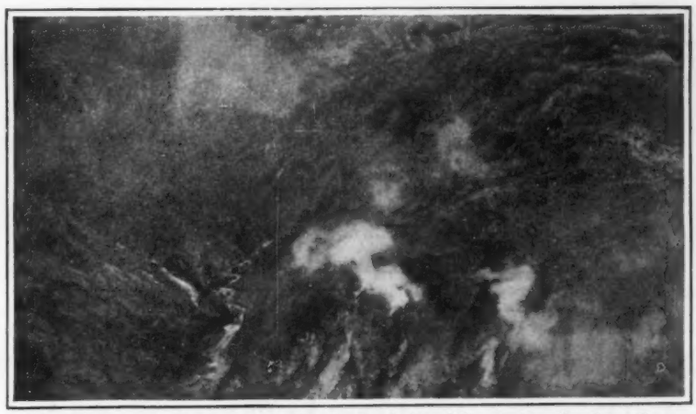
Shale-Bearing Rocks Whose Slow Spontaneous Combustion is Manifest in Clouds of Smoke and Steam

Photographs by Ellwood Atherton

THE spectacle of rain, fire and flood all occurring at the same time, is not an unusual sight in some of the canyons near Los Angeles. The most notable example is near Santa Monica which is on the southern coast of California. The precipitous sides of the canyons debouching into the Pacific Ocean in that vicinity are composed of clay and shale. Whenever rain falls on these rocks, great clouds of steam rise from the canyons. The canyon crests and faces are crowned by vitrified rock burned a dull red.

It is reported by the early historians that when the Mission fathers visited this region 150 years ago the natives avoided these places. They claimed that these mysterious canyons were the abode of evil spirits and the Indians could not be induced to guide the priests to their vicinity.

The three photographs accompanying this article were made during a recent rainstorm and show the bay of Santa Monica and its relation to the canyons, and the canyons themselves with the rising clouds of moisture and gas. During the infrequent earthquakes in this region the upper surfaces of the canyon sides give off sulfurous gases similar to those noticed during rainstorms.



When it rains the canyon bottom is flooded and the rock walls give off quantities of steam

Actual flame has also been reported in one of these canyons, and similar phenomena are said to occur at certain places in Santa Barbara County; hence the occasional newspaper accounts of active "volcanoes" near the coast of California. The phenomena are evidently due to fires in the petroleum-bearing shales which crop out in these regions. The cause of the fires is uncertain; they may be started by lightning or they may be a case of spontaneous combustion. Messrs. R. S. Arnold and H. R. Johnson, who investigated the subject some years ago, say:

"This unique variety of metamorphism has been at work locally in many regions of bituminous rocks in California, where a process of combustion of the hydrocarbon contents has altered the naturally white, soft shale to a rock of brilliant rose or brick-red color, and rendered it in cases hard and vesicular like scoriaceous lava. The resemblance of the products to those of volcanoes and the existence of centers like solfataras where the process of burning has been going on during the last half-century has given rise to the statement that there were living volcanic vents in this part of California."

In drilling oil wells burnt shale has been found at depths of from 90 to 1,000 feet, proving that the burning has taken place deep down within the oil-bearing formation, as well as at the surface.

Stratification of the rock in the burning canyon

Tumbleweed Becomes a Crop

ON the farm, as in other places, the best way to deal with an enemy is often to make him a friend. Sweet clover, now a recognized, valuable forage crop, was for many years among the most detested farm weeds of the Middle West. The Russian thistle, a tenacious weed of the Intermountain West, has made its debut as a farm crop under dramatic circumstances. Stockraisers in drought-stricken regions cut it and ensiled it extensively the past season. In some cases it was the veritable salvation of a discouraged farmer, whose planted crops had failed him. The Russian thistle along its numerous branches has an endless series of small needle-like spikes, but these in the silo lose all their terror. The stuff comes out first-class feed for livestock.

The Russian thistle is utterly dissimilar from the thistles most American children are familiar with. It was brought to the Dakotas by Russian emigrants. It is a bulky plant often several feet wide and high. It will flourish in desertlike places where cactus is the only other vegetation. The Intermountain West does not call the plant by its original name. Its home-made term, the tumbleweed, is far more expressive. The dead plant breaks off readily at the ground in the fall. Then the wind seizes it. The tumbleweed's structure is so tough, yet resilient, that a plant will whirl for miles before the wind, only stopping when hung up by a fence, a ditch, or some other obstruction. So out of proportion to its size is the weight of the big plant that it will lightly fly high in air during a hard gale.

Children in the Dakotas, Montana, Wyoming, Colorado, Idaho and Utah, find tumbleweed a splendid late-fall playfellow. Two big weeds are harnessed to a string, and in front of a wind they go hurtling down the street "driven" by shrieking, happy boys and girls. At other times, the weed becomes a kite, attached to a long cord dangling from a fish pole.

Another western plant formerly regarded as undesirable is yucca, or soapweed, which in the silo is found to make edible and good livestock feed. The plant is called soapweed because Mexicans and Negroes make a soap from its juice. It is also called the Spanish bayonet, and the dagger plant, from its shape.

Santa Monica Bay, with the burning canyon just discernible at the foot of the long wharf

Electric Lighting Forty Years Ago

A CORRESPONDENT brings to our attention the following interesting passage, which he has translated from *La Illustracion Espanola y Americana*, of Madrid, issue of January 22d, 1880:

Has Thomas Alva Edison solved the famous problem of economics and practical lighting by electricity? Scientific circles and great gas companies of the new and old world have occupied themselves with naught else for the past weeks.

To date none can answer this question in a correct sense of the world. A newspaper of New York, the SCIENTIFIC AMERICAN, of renowned competence in these matters expresses itself in the following manner: "If Mr. Edison's lamp triumphantly withstands the tests of time, it is unquestionable that he has given solution to a difficult problem, that of creating what we have with such anxiety waited for; in short a new practical lighting system, economical and usable by the majority."

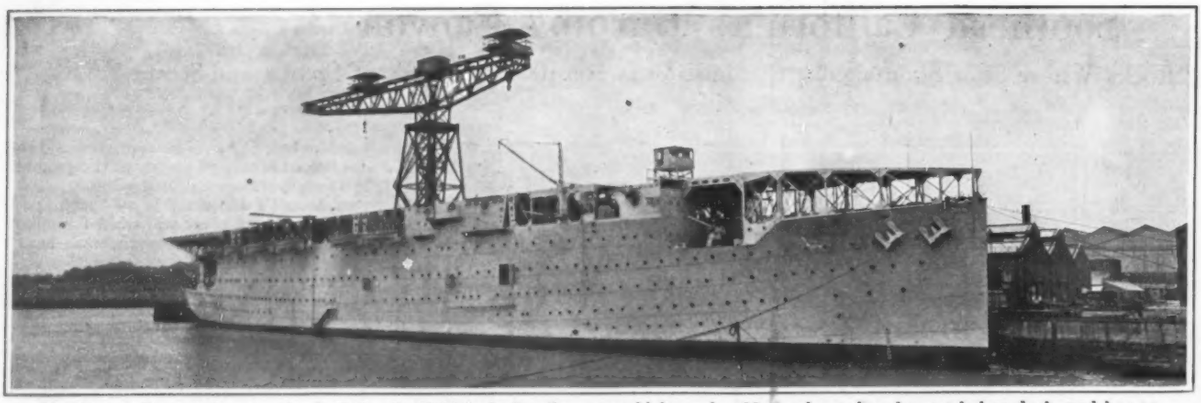
However, we consider it our duty to acquaint our readers with what is positively known to date regarding the latest discovery of Edison, demonstrated for the first time in "Menlo Park" on the night of December 30th.

By many experiments the celebrated physicist has succeeded in placing small pieces of Bristol cartulin recut in the shape of a horseshoe, into an incandescent material less fusible than platinum and which obtains a degree of hardness equal to that of granite by the passage of the electric current.

The editor of The SCIENTIFIC AMERICAN claims to have read a newspaper by the light of an Edison lamp hung at a distance of thirty-five meters.

These electric lamps may be attached on the wall in the manner of gas brackets.

It seems useless to tire the attention of our readers with a description of the generators and machines which have enabled Edison to maintain electric illumination in all the houses of Menlo Park for a space of ten consecutive nights, with satisfactory results, to judge by the accounts published in the newspapers. Some of these assure that lighting by the electric lamp will bring a cheaper result than that submitted by the most inferior oil; but as we have not yet sufficient data, we limit ourselves to express our wish that all doubts will be done away with and that Alva Edison's new invention will be a worthy crown for his already immense reputation in the scientific world.



The "Argus," a seaplane carrier built by the British during the war, which carries 20 seaplanes in a hangar below deck, and has an upper flying deck, for launching and landing seaplanes, 535 feet long by 68 feet wide which is clear of masts, smokestacks and deck structures

The Seaplane Carrier "Argus"

A Ship With a Five-Hundred-Foot Starting and Landing Platform for Seaplanes

AT the opening of the war in Europe, a first-class cargo and passenger ship which was 535 feet long, 68 feet beam and 40 feet deep was being built for an Italian shipping company. Because of the rush of war orders, work on this vessel was discontinued; but in 1916 the British admiralty decided to take over the ship and transfer her into a large seaplane carrier and this work was done at the Wm. Beardmore & Co.'s yard on the Clyde, where the ship had been laid down.

The admiralty had already done some work along these lines in the case of the 32-knot battle-cruiser "Furious," which ship has already been illustrated in the SCIENTIFIC AMERICAN. In the case of the "Furious," a flying deck extending from stem to stern was built above the original structure of the ship, and because of her length a long stretch of free and unobstructed platform was available. Due to the obstructions presented by the large smokestack, the bridge, and the tripod mast, it was not possible, of course, to utilize the whole seven to eight hundred feet length of the vessel as a continuous platform.

In reconstructing the "Argus," however, it was determined to provide an absolutely clear runway for the whole 535 feet length of the vessel and also to build within her a large hangar capable of housing 20 seaplanes and the various workshops, storerooms, etc., necessary in such an installation. Wind-tunnel tests made to show what air disturbances are produced by the upper structures of a ship when driving at speed showed that, to get the best results, the space between the hangar roof and the flying deck must be left as open as possible. Consequently, the flying deck was carried upon an open frame-work consisting of steel columns braced diagonally as shown in the accommpanying illustrations.

It was also found that the emission of gases through the usual vertical funnels of a steamship produce serious air disturbances, and consequently it was decided to connect the up-takes from the boilers with two large horizontal funnels, one on each side of the ship, placed below the flying deck, which would lead the gases to the stern of the ship and there discharge them. These horizontal funnels are provided with expansion joints, and they are kept cool by means of ventilating fans. At the after-ends of the funnels are large discharge fans, each about 10 feet in diameter, which are driven by 74 brake horse-power electrical motors.

The flying deck is entirely clear of obstructions. There are no funnels, masts or pilot house visible when the flying platform is in service. The small pilot house shown in one of our illustrations can be raised or lowered by hydraulic power. It is normally in raised position, but when going into action it is brought down until its roof is flush with the flying deck. There are two derricks forward for lifting the planes from the water, should they alight there, and below the after-end of the flying deck, which has an overhang of 80 feet, there are two steel electric cranes for the same purpose.

The speed of the ship as originally designed was increased from 18 to a maximum of 20¾ knots with an ordinary service speed of 20 knots.

Below the flying deck there has been built a seaplane hangar which is 330 feet long by 68 feet wide, with a clear interior width of 48 feet designed to accommodate 20 seaplanes.

This hangar is built above the original shelter deck of the ship, the roof above being carried on deep web frames. These frames are carried up the ship's side to a height of 25 feet 6 inches above the original sheltered deck. The roof is built of steel on widely spaced transverse girders and longitudinal beams and there is a clear headroom in the hangar of about 20 feet. In the hangar is a thermotank heating unit, and on the walls are radiators, racks for carrying torpedoes, and also an overhead runway for transporting the seaplanes.

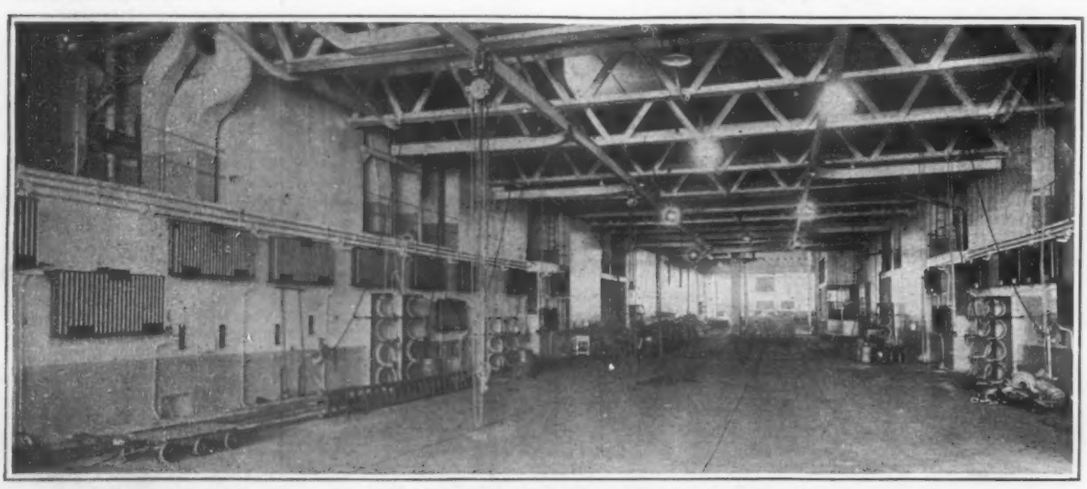
In the storerooms are accommodated spare parts, wings, propellers, torpedoes and bombs, and forward of the hangar are large workshops fully equipped with machine tools. One of our illustrations shows part of the work-shop equipment, namely, a test-house for airplane engines and propellers, which has the usual protective netting around it.

The navigating bridge, houses for officers, etc., are placed forward under the flying deck, and only the chart-house ever appears above this deck. The chart house is capable of being raised above the flying deck level or lowered to a stowing position under the flying deck by hydraulic power. When in the raised position, it commands a clear, allround view. The chart-house travels in vertical guides, and it is raised and lowered by a hydraulic ram.

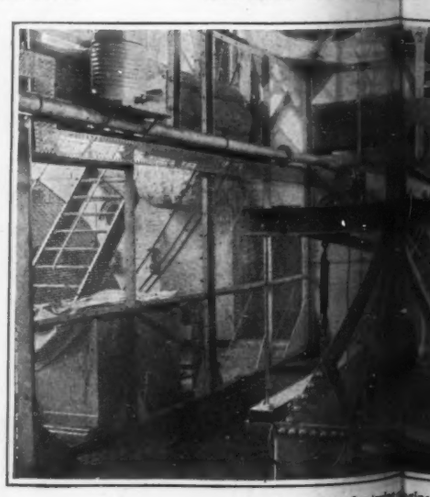
There are two electrically controlled elevators for lifting the airplanes from the hangar to the flying deck, and when these are not in

Stern view showing the overhang of flying d

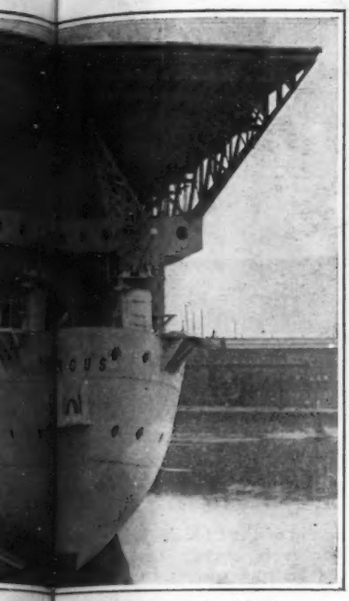
Bow view. Note the



The great hangar below deck, which is 330 ft. long by 48 ft. wide and accommodates 20 seaplanes

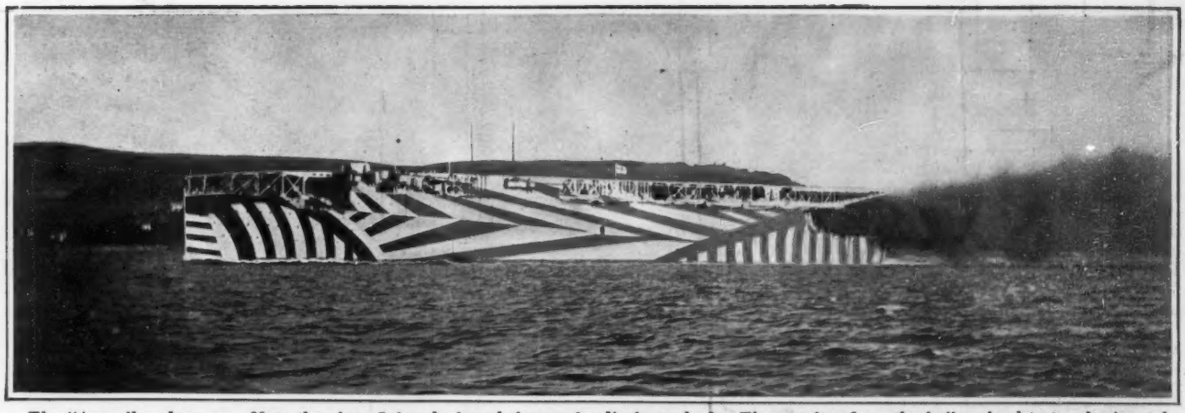


A testing room for



verhang ing deck and two of the 4-inch guns

the rails supporting the flying deck



The "Argus" under way. Note the clear flying deck and the smoke discharged aft. The uptakes from the boilers lead to two horizontal funnels extending aft, one on each side of the ship, which discharge the gases astern, where they do not provoke air disturbances or confuse the flyers

use, the hatchways are closed by sliding platforms. The after lift is 60 feet long by 18 feet wide and the forward lift is 30 feet long by 36 feet wide. Each of these can lift the largest Service planes with the wings folded back. As soon as the planes reach the flying deck, the wings are swung forward and coupled up and the machine is ready for flight.

To facilitate the landing of the airplanes on the after-part of the flying deck at night time, special illuminating arrangements are provided for the guiding of pilots. In addition to lamps at each side and across the flying deck to guide planes when landing at night, steam jets are fitted forward at each side and at the stem of the ship for guidance of the planes in maneuvering during daylight. To retard the aircraft when they land, a special arrangement of wire mattresses is provided.

In addition to the storage for aircraft in the hangar, provision is made for carrying them on the flying deck, in which case a timber palisading can be raised about this deck to act as a wind screen. The palisades are so arranged that they can be raised simultaneously 14 feet above the deck level. Outside of and around the flying deck is fitted a wide safety net.

Two signal and wireless telegraphy masts are arranged as shown above, so that they can be lowered flush with the flying deck. There are special contrivances and winches for overhauling all slack rigging; this also applies to rangefinder and gun control instruments for use with anti-aircraft guns.

The ship is armed with four 4-inch anti-aircraft guns, which can also be used against submarines, and two 4-inch quickfire guns. They are so placed as to afford all-around and overhead protection. Our thanks are due to Messrs. Wm. Beardmore & Co., the builders of the "Argus," for our photographs and to London *Engineering* for the descriptive matter of this very interesting ship.

Valuable By-Products from Gold Dredging

By Arthur L. Dahl

THE mining of gold by the dredger process has been practiced throughout the world for many years, and in this country, the dredging centers of California have enabled that State to remain in the front rank of gold producers in spite of the virtual suspension of hydraulic mining and the decline of many of the larger lode claims. Many millions of dollars' worth of gold are annually taken from the earth by the California gold ships, and hundreds of acres of ground are plowed to a depth of from 15 to 45 feet in the quest for the gold.

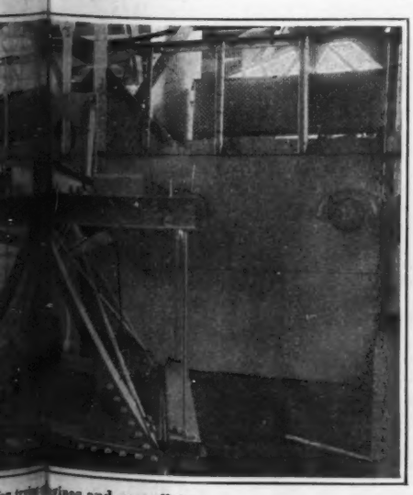
Under ordinary circumstances, when land has been thoroughly dredged it is abandoned, and the up-turned soil is left in the form of long hills of cobblestones, just as they are delivered from the dredge stacker. Whatever silt and fine material is excavated usually seeks the lower levels through the interstices of the stones, and is thus lost. Practically no vegetation grows naturally upon the tailings piles, and until recent years, no effort was made to utilize the great mountains of rounded stones raised by the dredges.

The lands dredged were usually rocky river washes, barren of vegetable growth, incapable of raising crops, and in many cases were subject to overflow, and thus rendered unsuitable for permanent use. Occasionally, however, an orchard tract or cultivated field would be embraced within the dredging area, and the value of the land for mining being greatly in excess of its value for agricultural or horticultural purposes, the lands passed to the dredging companies and were mined.

Fortunately for the State, the pioneer dredging men were made up of the type that believed in developing every resource of their community. They had other interests in the vicinity—orchards, ranches, electric railroads—and they did not like to see even apparently barren lands abandoned after the dredges had taken huge fortunes in gold from beneath the surface. So while the number of the gold dredges was multiplying, and the search for newer dredging fields was continued, several of the largest operators at Oroville organized a company to conduct experiments in utilizing the millions of tons of cobblestones turned up by the boats. A rock crushing plant was constructed in the midst of the tailings piles, and more than a hundred thousand dollars was spent in an effort to crush the tailings. Owing to the extreme hardness and the rounded, smooth character of the cobblestones, however, the first attempts to produce a commercial product were failures, as the ordinary rock-crushing machinery was inadequate to meet the strain. However, the operators persevered, and sunk another hundred thousand dollars in new machinery designed especially by their engineers. With a plant built almost entirely of manganese steel, the cobblestones were conquered, and various sizes of crushed rock were produced.

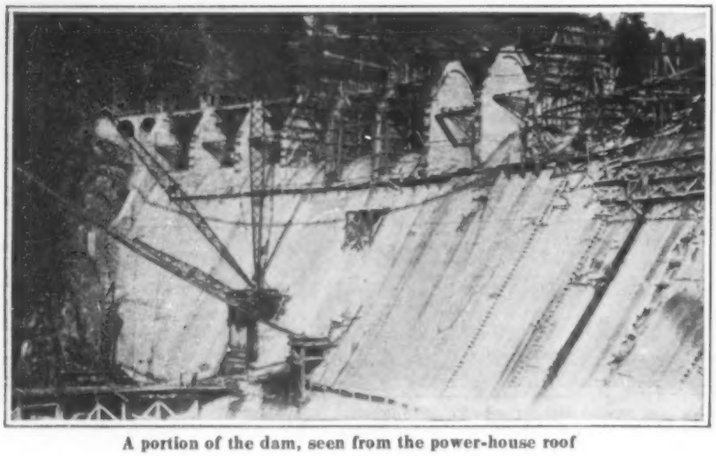
With practically unlimited quantities of crude material available near their plant, the dredge men thought the returns from their new industry would equal that of gold dredging, but they soon found that it was necessary for them to create a market for their product. Their competitors who sold natural crushed rock of a softer nature spread reports of the extreme hardness of the new product that prevented it from knitting properly when used with cement, and a great deal of pioneer work was necessary to get the new material introduced into nearby markets. But the men back of it were fighters,

(Continued on page 640)

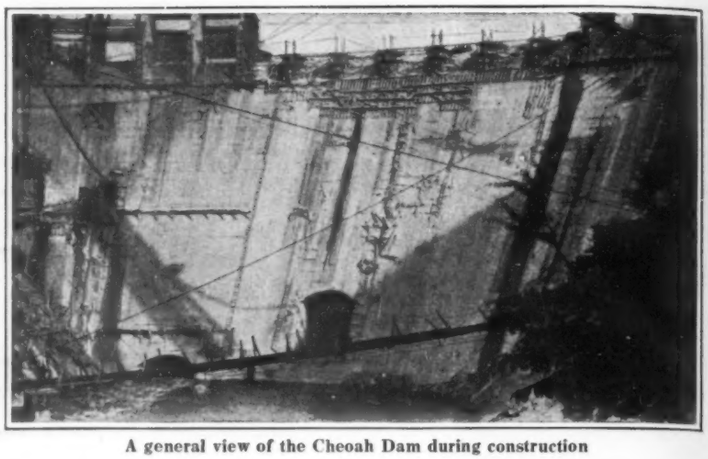


er trying engines and propellers

At the bow of the "Argus" showing forecastle deck and the supporting structure for the flying deck



A portion of the dam, seen from the power-house roof



A general view of the Cheoah Dam during construction

Tennessee's Big Dam

IN connection with a big aluminum refinery at Maryville, Tenn., a dam was completed last winter after two years work that ranks among the very biggest of its race. In this country it is surpassed only by the Roosevelt Dam—and by Niagara Falls, if we are to permit Nature to enter her handiwork in the contest for priority.

The new dam is located at Cheoah, 47 miles from Knoxville. The services of 1,200 men were required continuously in its construction. It will yield 80,000 horse-power when arrangements are completed for the utilization of that amount, and it is to be supposed that this will be enough to meet the demands for a while, even of such a voracious consumer of electricity as the refiner of aluminum.

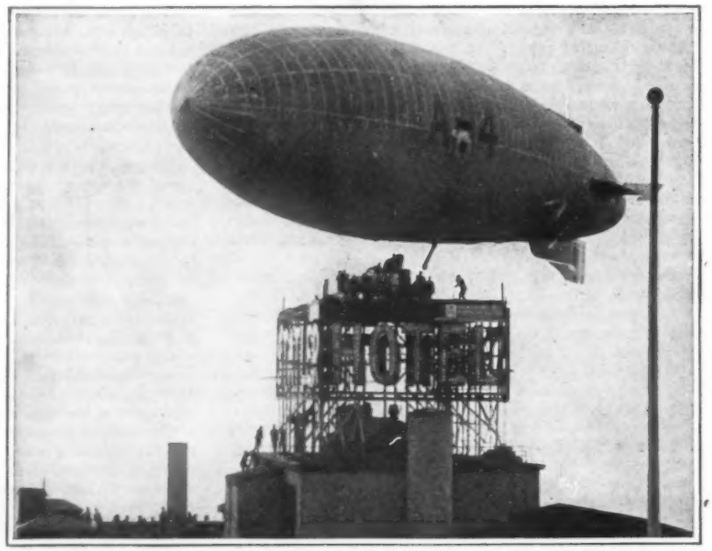
The dam is built in a deep ravine, with towering natural elevations on both sides. Accordingly the discrepancy between its length at bottom and at top is not so great as is often the case; it is 350 feet long at its foundations, and 725 feet along the crown. At the base it is 175 feet thick, tapering to a width of 12 feet at the top. Its height, from the lowest foundation footing to the crest, is 225 feet, while from the surface of the water to the highest point of the dam is 210 feet. It contains 200,000 cubic yards of concrete—and a cubic yard is a good deal bigger than the average intuition would picture it. Perhaps it would be more impressive to point out that 200,000 cubic yards is the equivalent of 5,400,000 cubic feet; and to bring the matter still nearer home, a cubic foot is just about twice as big as the average apartment-house serving of ice. So if the dam were ice, and available for distribution to a single consumer, it would last about 30,000 years.

A good many impressive statements are made concerning the amount of water impounded behind the dam. Of course this does not compare very favorably with this feature of the Ashokan Dam by means of which New York is assured of a supply of pure mountain water; for Cheoah Dam occupies no such strategic point as does the other one named. Nevertheless, when the gates of the completed dam were closed for the first time, it required six days to fill the lake behind the big structure, a lake 12 miles in length. As the water that flows over the top of the dam strikes the surface of the river below, it raises a spray over 100 feet high—a spray that can be compared only with that of Niagara. It is suggested that had it not been for the heavy rains of early December, the process would have taken perhaps three times as long.

To dispel any doubt as to just what the figure 80,000 horse-power means, we are told that the combined consumption of Knoxville, Chattanooga, Nashville and Memphis for electric light and power is but little over 70,000 horse-power. These cities had an aggregate population, in 1910, of a third of a million, and doubtless have increased materially from this figure in the eight years that have elapsed since then.

An interesting item, that puts the project almost in the class with the Catskill Watershed which submerged whole villages and long stretches of public road, is found in the fact that over a million dollars worth of construction work recently completed for a new branch of the Southern Railway was bought, paid for, and flooded by the builders of the dam. The railroad relocated its line at a higher grade, and was glad to do so in view of the big increase in business to which it can look forward as the result of the operation of the dam.

The water went over the top of the Cheoah Dam on Friday, December 13th—so it is obvious that the aluminum people are not a bit superstitious. It was hoped to have the dam at work at its full capacity by March 1st.



Dirigible landing on the roof of a hotel in Cleveland, Ohio, during a recent trial flight

The Aerial Bus

A PASSENGER "air-line" between Cleveland and Akron, Ohio, and other cities within a hundred-mile radius seemed a thing of the immediate future when Ralph H. Upson, a prominent aero engineer, stepped out of a dirigible balloon that had landed on the roof of a hotel in Cleveland's busiest metropolitan section at 7.30 o'clock on the evening of May 23d.

The balloon carried Mr. Upson and Major C. H. Maranville, head of the army-navy air training station near Akron, Ohio, from Akron to Cleveland to be guests at a banquet in the hotel that evening. The trip was made in the face of a stiff wind in about an hour, and although both wind and rain interfered, a landing was effected on a platform built on the hotel roof of 30 x 50 feet dimensions.

Upson, who planned the trip, told members of the Society of Automotive Engineers of Cleveland, at whose dinner he was guest, that a 12-passenger airship was being constructed to make flights during this summer to the hotel roof from Akron.

The dirigible was steered slowly over the hotel, and ropes were thrown down to watchers on the platform. The carriage of the balloon was drawn down slowly to the platform. After the passengers had been discharged, the dirigible returned to Akron.

Mr. Upson began ballooning in 1906 in France. In 1913 he captured the James Gordon Bennett cup by a 500-mile flight in England, and in 1916 introduced the army kite-balloon on the Mexican border.

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Kalut Volcano, Java, which recently exploded and caused the loss of 5,000 lives. The photograph shows the volcano in the state of mild activity usually characteristic of the island

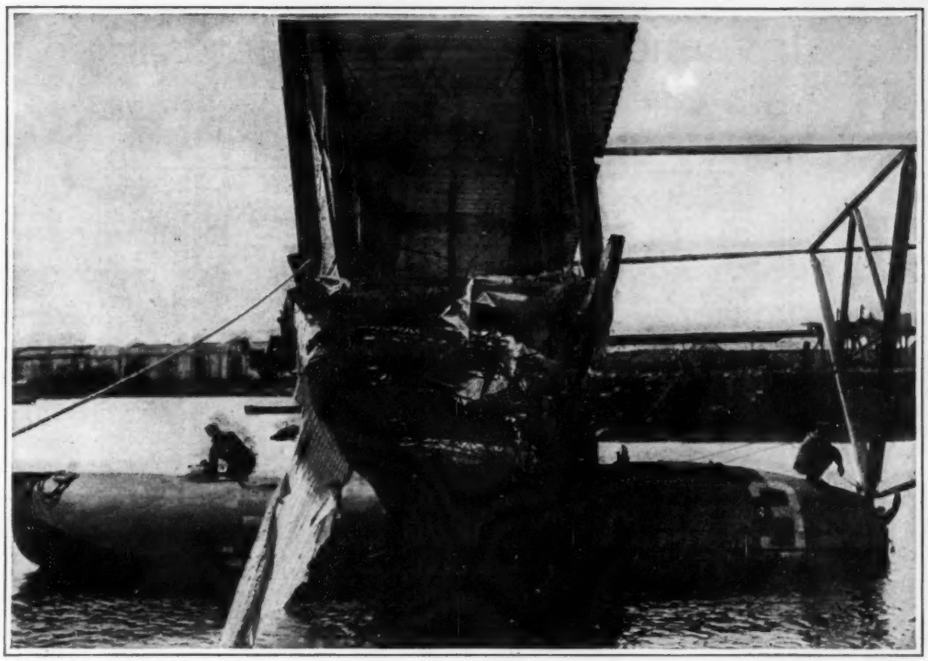
Recent Explosion of Kalut Volcano, Java

ON May 20th, 1919, the volcano of Kalut in eastern Java burst into violent eruption causing great destruction and extensive loss of life in the District of Brengat and in the vicinity of Blitar (lat. 8° S. long. 112° E.). Our photograph shows Kalut volcano at one of its more active periods, when it was giving off moderate clouds of steam, and slowly adding to the very low cinder cone its usually trifling activity has built.

One is never surprised to read of more or less frequent and violent volcanic activity from the Javanese centers. Java is one of the most pronouncedly volcanic regions of the world, for its size, numbering 12 or 13 active volcanic cones and a very large number of historically inactive (i. e., "extinct") volcanoes. The whole island owes its character of terra firma to volcanic structural activity, and is well known as forming a long link in the Java-Sumatra volcanic chain. Most of the Javanese cones show but slight activity amounting to slight ejection of steam and scoriae or cinders, and small bombs. On occasion however, some peak of the chain breaks out with suicidal violence, as happened in 1882 when Krakatao in the Straits of Sunda blew off its own head and shoulders,

scattering death and destruction far and wide, and projecting into our upper atmosphere a cloud of dust that persisted for several years and produced the most magnificent twilight colorings that educated men had ever seen. Since then violent volcanic explosions elsewhere have also been accompanied by similarly colored twilights, and it is probably owing to this association of ideas that some of our daily papers have recently cautioned us to be on the lookout for such phenomena again. However, there is no information yet at hand to indicate that this recent explosion of Kalut attained the violence requisite to produce such effects.

Volcanoes are predominantly developed along great breaks or faultings in the earth's crust, and in or near the present sea coasts. It was long believed that these two facts were of great significance concerning the origin of volcanoes; but many have also been found in locations where neither sea nor present topography and fractures can have been of any determining value and the earlier view has been modified. It has finally been concluded that the heat betrayed by volcanic activity is probably a remnant of the original heat of the earth when in a much more highly heated state, and that the molten rock or magma is largely a remnant of the original molten globe. The water which escapes as steam in nearly all eruptions—for it has been recently proved that it is water—is probably in large part an original constituent of the molten rock, and is associated with a number of other gases which also enter into the composition of the rocks. The explosions and eruptions result from variations in presuure within the earth's crust due to slow valancing movements of the segments of the earth. In the case of the less violent eruptions the stresses within the hot earth are relieved rather gradually, a little at a time; the violent and cosmically significant explosions seem to be the sudden relief of stresses which have been slowly accumulating for centuries until the critical point of the superjacent crust has been exceeded.



Official photograph, U. S. Naval Air Service

Wreckage of the lower left wing of NC-3, due to pounding of the seas in heavy weather. Note that the main trusses, wing beams, struts and ties are intact

The Transatlantic Seaplane of the Future

THE Navy has announced that the flight across the Atlantic was undertaken, as we showed last week, in conformity with its plans, formulated during the war, for building a fleet of anti-submarine flying boats, which would be capable of flying to the European submarine zone under their own power. Although the close of the war ended the need for flying the boats over for purposes of war, the Navy decided to go ahead with its program for the purpose of obtaining the valuable data which would be acquired in a transatlantic flight.

We publish two photographs of NC-3, taken upon her arrival at the Azores, which are of extraordinary interest because of the lessons which they teach; for as we noted last week, Admiral Taylor in proposing the construction of these boats stated that they must be seaworthy, that is to say they must be as capable of functioning when on the surface of the sea as when they are in the air. It is entirely logical on the part of the chief instructor to lay strong emphasis upon this requirement; for the advantage of the flying boat or airplane over the land plane is that it is not obliged to make a continuous flight from land to land, but may, if it wishes come down upon the sea for a replenishment of its fuel supply, or the adjustment and repairs of the engines, or even of the plane itself.

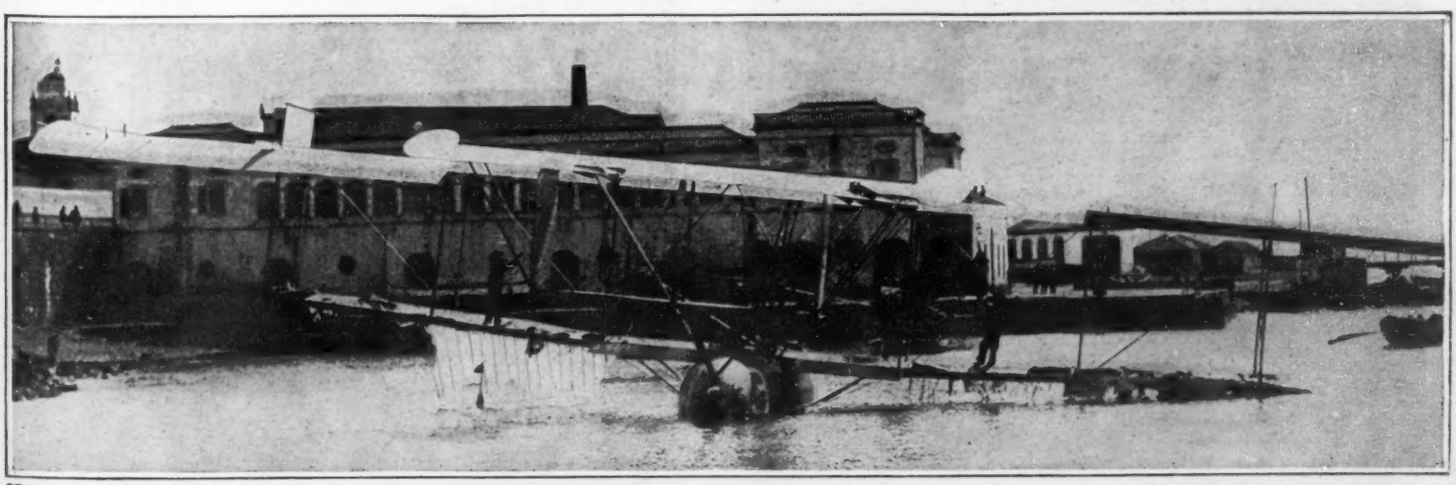
Therefore, a flying boat, if it is to deserve the name, must be seaworthy, not merely in calm weather but when the wind is strong and the seas are high. These two photographs show that in the present state of the art we have yet to build a plane of the type which Admiral Taylor called for in his original memorandum. Two out of the three NC boats were forced to descend in strong winds upon a rough sea. One of these sank while being towed to port, and the other was completely wrecked in what is obviously its most vulnerable part, namely, the lower wings. These pictures testify at once to the strength and the frailty of the wing structure. They show that, in spite of the heavy buffeting of the seas, the main trusses came through the ordeal intact. The lower wing-beams are in place and apparently in line; what collapsed were the transverse ribs and the canvas covering. The boat and the outrigger frame for carrying the tail seem to be in good shape, and the tail itself, except for a slight tear in the canvas seems also to have come through in pretty good condition.

The first and obvious lesson is that it will never do to place the present type of canvas-covered wing so near to the surface of the water. One way out of the difficulty would be to abandon the lower plane altogether, except, perhaps for the middle third of its length in the way of the engines, and build the future flying boat as an out-and-out monoplane, with the carrying surface 15 to 20 feet above the sea. If the size of the monoplane wings would be too large and the raising of weights would render the flying boat too unstable, the only other plan would be to provide hinges at the panel points adjoining the engines, and have them so arranged that the hinge could be quickly unlocked as soon as the boat reached the water, and the wings swung back into the longitudinal position and made fast to the boat structure. This, of course would involve building a continuous boat up to the tail structure, in order to provide a point to which the swung-back wings could made fast. A boat of this type, with greater beam for stability, could be handled in a rough sea.

As to the question of what type of airplane would have the best chance of crossing the Atlantic in a non-stop flight, it is divided between the small single-engine, high-speed plane and the large multiple-engine plane of lower speed. The former has the advantage that the number of hours in the air is considerably less, and there is a greater possibility of getting across on a favorable day before a sudden change for the worse of weather conditions occurs. On the other hand, the breakdown of the engine means the loss of the whole trip.

Just now British opinion favors the construction for a straightaway flight like this of large biplanes, carrying a plurality of engines, five, six or seven, as the case may be, with the engines arranged in banks within the nacelle and with chain or shaft transmission to the propellers. With a plane of this type, two or more engines might be out of service without rendering a descent necessary. The placing of all the engines in the nacelle and under cover, would make it possible to effect repairs, change spark plugs, etc., while the machine was in the air.

In closing, we wish again to bear tribute to the pluck and skill with which Commander Towers navigated his wrecked craft in rough water for over two days over a distance of some 200 miles. Everyone should see the moving pictures showing NC-3 driving into Ponta Delgada harbor before a stiff wind and sea.



Official photograph U. S. Naval Air Service

NC-3 in port at the Azores. Stern view, showing canvas stripped from the lower wings. The main structural framing stood the severe test

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A New Bank Desk

By Cozymine Wilson

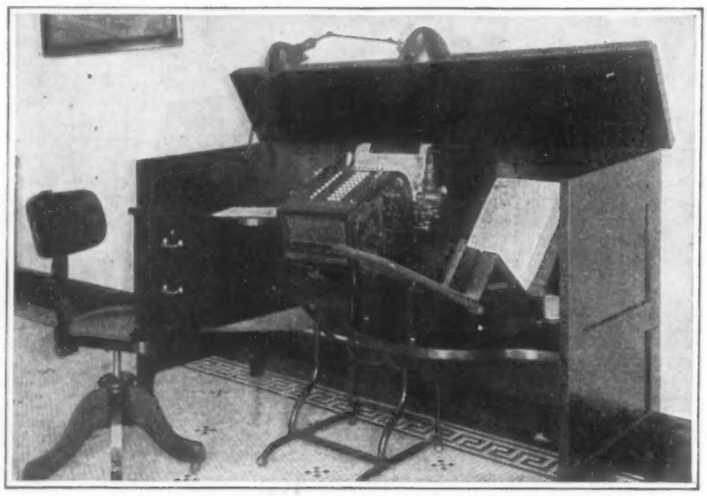
A BANK desk of great convenience to the banking and commercial world has recently been invented by A. E. Falls, a bank employee of Chicago. The Falls desk proves its efficiency in that it reduces floor space ordinarily used by one half and increases the efficiency of employees from 10 to 15 per cent.

A little adjustment of the top which may be raised or lowered at will as any ordinary lid and presto, the desk becomes a standing desk for assorting checks, etc., with lid down, or a bookkeeper's desk for computing machine and ledger, with lid up.

When the top is folded back, the bookkeeper sits on his stool oblivious to his best pals or the pretty girls at the next desks because he is shut off from everything but the business in hand.

On the left side of the bookkeeper are two drawers, the top of which may be used for a shelf on which to place the work for recording. On the right side is another shelf somewhat lower than that on the left which is used for ledger rack and ledger. The center space accommodates the computing machine on its own stand.

Desks range in price from $90 to $125 according to requirements. They are made to order to fit any bookkeeping or computing machine used in commercial or banking work, and to carry any loose-leaf ledger rack, or tray or the larger sheets of the Boston system. A popular size is two feet, two inches long; five feet, six inches wide, and 41 or 43 inches high. An adjustable light with improved knuckle joints which enable the light to be used freely in any position, accompanies the desk. Many banks of Chicago and other large cities have installed the Falls bank desk in the last year and found it satisfactory.



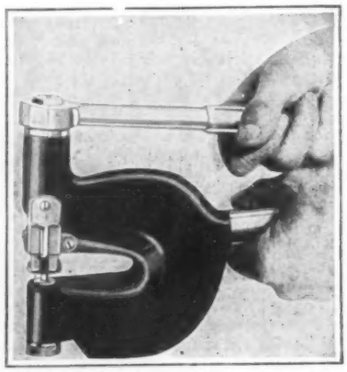
A desk that can be adjusted for standing and sitting jobs

The Motorcycle Turned Taxicab

IT has remained for the English to develop the conventional motorcycle with sidecar into a public taxicab. By building a somewhat heavier and longer sidecar than usual, the English have arranged it for carrying two passengers, while the motorcycle carries the driver, all as shown in the accompanying illustration. The sidecar is provided with a top and side curtains, making it available in all kinds of weather. The springs are said to be properly designed and distributed so as to take care of road irregularities. All in all, the motorcycle taxicab covers any distance in better time than does the automobile, and the fare is considerably cheaper.

A New Idea in Hand Punches

NO other punch can be operated all day with as little fatigue to the mechanic as the one shown in the accompanying illustration, according to its inventor. And he proceeds to explain this ease of operation by pointing to the absence of long, clumsy handles; the fact that the operator is brought close to the material; the punch marks are followed quickly and accurately; the punch is extremely light in weight; the action is quick and positive, only half a turn of the lever being required to drive the punch through metal; the handle above the center keeps the punch naturally upright; the punches and dies are more easily changed; the punch may be easily clamped in a vise, if desired; and there are no pipes to fit or adjustments to make.



This little hand punch does work with a minimum of fatigue

The new punch is intended for the tool kit or shop. It is powerful, compact, portable, and speedy. It weighs five pounds and is 9½ inches long. It punches 1/32, 3/16, 7/32, and ¼-inch holes in metal up to 10 gage. It requires little oiling and no adjusting.

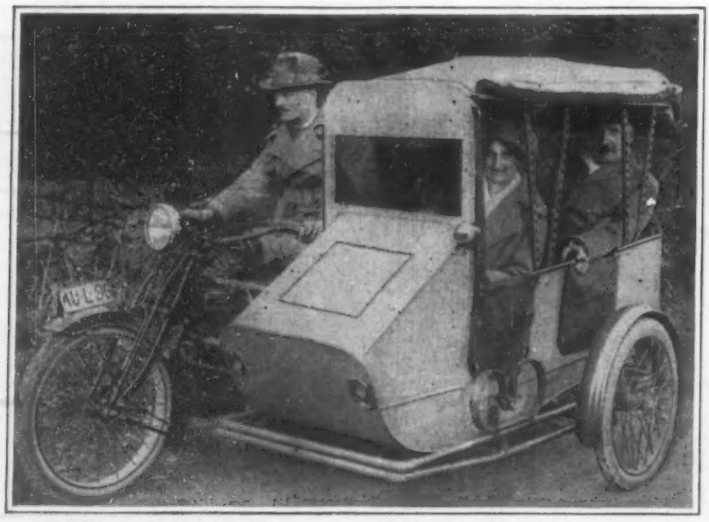
In the illustration may be noted the deep throat and one-piece automatic, disappearing stripper, giving a clear view to punch and punch mark for the next operation. The design permits several sheets to be punched with one operation. Also, the design is such as practically to eliminate punch breakage, and positively will not leave a bur on the metal, according to the inventor's claims.

Collapsible Tube Holder

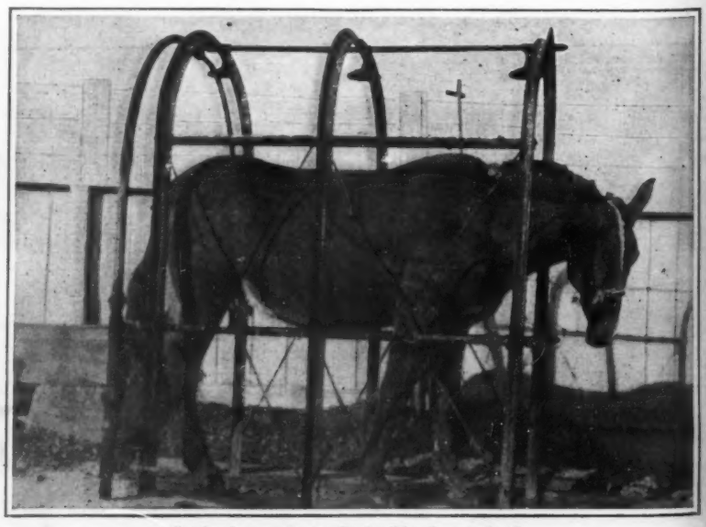
THE use of collapsible tube containers for tooth pastes, cold creams and toilet articles is too well established to require extensive explanation. And it is also well known that such tubes, convenient as they are, are open to the one objection of becoming unsightly when their contents are pretty well reduced and the tube is more or less of a shapeless mass. To overcome this objection William J. A. Brand of Brooklyn, N. Y., has invented a simple U-shaped holder which screws against a wall and which serves to hold a collapsible tube in an upright position, with the spout below. Thus, to dispense the contents the user merely has to press the collapsible tube held in the holder, starting at the upper end and going further down as the contents become less and less.

Shower Bath for Mules

ONE of the large mining companies has installed shower baths for its mules that work in the mines. The ideas of humane treatment for the laborer that are being used by all the large companies have here extended to the animals, and the tired mules or horses that have worked all day in the tunnels of a mine are refreshed by a bath that leaves them relaxed and ready to rest. It has been found that the animals that are taken care of, given a good place to sleep and otherwise treated kindly last much longer on the job and do better work. The framework of the shower bath apparatus is like a stall into which the mule is driven. From a water pipe on top of the structure three sprays are placed at equal distances so that when the water is turned on the animal's back is covered with spray. All the dust from the coal is washed away leaving the beast fresh. At first the mules were somewhat suspicious and fearful of this contrivance but in a very short time they needed no persuasion to enter the stall for a shower.



Motorcycle with special sidecar used in England for taxicab service



Coal-mine mule ready for his shower bath

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

POCKET.—H. ELOESSER, Elоesser-Heynemann Co., 77 Battery St., San Francisco, Cal. The invention has for its object to provide a pocket more especially designed for use on overalls, trousers, coats, vests and other garments such as are generally worn by artisans, and other persons arranged to accommodate such articles as a rule and pencil, to secure such articles without danger of their dropping out, and to allow of conveniently removing either article without disturbing the other.

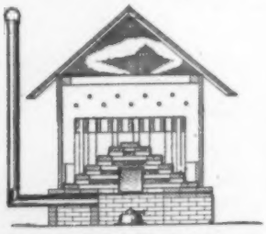
Electrical Devices

ELECTROMAGNETIC TUBE TESTING DEVICE.—A. PAQUIN, 152 Marguette St., Montreal, Quebec, Canada. The invention relates to a device for testing the bore of a non-magnetic tube for locating the presence of projecting edges, lumps and other imperfections that would prevent the insertion or drawing of wire through the tube. The object is to provide a floating armature which maintains a stationary position within the bore of the traveling tube being tested under the action of magnetic forces, until an obstruction is reached, which results in the giving of a signal.

SHADE HOLDER FOR ELECTRIC LAMPS.—W. H. PRICKETT and J. F. MORTON, 56 S. Hermitage Ave., Trenton, N. J. The inventon relates to shade holders adapted for use with an ordinary incandescent lamp socket. A specific object is the provision of a holder having screened ventilating aparatus in combination with a protector which encircles the lamp socket and rests on the shade holder in spaced relation thereto, whereby rain and dust are prevented from entering the shade, although free space is provided for the circulation of the air through the apertures of the holder.

Of Interest to Farmers

CHICKEN BROODER.—R. R. MURRAY, Milford, Texas. This invention relates to poultry raising, and has particular reference to the care of young chicks. Among the objects is to provide a brooder adapted especially for outdoor use or



TRANSVERSE SECTION OF THE DEVICE

independently of a poultry house. The device comprises a hollow pyramidal chick support with a source of heat within the base, depending fabric strips, a ceiling of open mesh material, and a suitable roof, the products of combustion being conveyed outward through a flue.

Of General Interest

ICE MAKING APPARATUS.—A. M. FOWLER, 1800 Diamond Ave., S. Pasadena, Cal. The invention relates more particularly to means utilized in connection with ice forming cans and other containers, whereby to agitate the fluid contents of the can during the freezing operation, in order that clear clean ice may be formed from undistilled water, the object being the provision of a simple arrangement which will avoid the bulky attachments now in use requiring constant attention.

BAG FASTENER.—J. W. KAUFMANN, 1730 N. Monroe St., Baltimore, Md. The object of the invention is to provide mechanism in connection with bags for securely connecting the ends of the frame, that is, on opposite sides of the lock the mechanism comprising spring controlled catches arranged to be released by push buttons outside the bag, wherein means is provided for normally holding the catch in released position until the parts of the frame are separated for the opening of the bag.

MOVING PICTURE CAMERA.—S. M. LAWHUN, 1893 Vyse Ave., Brooklyn, N. Y. A specific object of the invention is the provision of a moving picture camera having means for registering the opening of the shutter with the lens, removing the film from in line with the lens to an out of the way position in cooperative relation with the lens, whereby the camera can be refocused without exposing any portion of the film to the light.

SYSTEM OF CAMOUFLAGE.—C. H. BARBULL, 4516 Burke Ave., Seattle, Wash. The invention has for its object to provide a system of camouflage adapted for use with vessels, fortifications, airplanes, and the like, wherein means is provided for discharging oil, smoke, steam or chemicals from the sides of the vessel, to conceal the same, or for instance, to keep the sides free from ice, for cooling the vessel or for quieting the waves by the discharge of oil.

SHELL PACKING.—I. LUDLOW, 1540 Acolian Hall, 33 W. 42d St., New York, N. Y. Among the principal objects which the invention has in view are to protect the rifling band of ordnance shells, to adapt packings for use on shells of several different sizes, to facilitate the exposure of the bands, and to adopt packing devices which may be used a number of times.

EMBROIDERY FRAME.—T. OKIHARA, 50 N. Bertania Ave., Honolulu, Territory of Hawaii. The invention relates particularly to an embroidery frame having rollers to receive the fabric; an important object is to provide a frame in which the effective size of the frame may be varied to accord with a larger or smaller piece of material to be worked. A more specific object is to provide a knock-down frame with ratchet and pawl control for the rollers in either adjustment of the frame.

SHIPPING RECEPTACLE.—S. SARNOFF, 15 Washington Place, New York, N. Y. The object of the invention is to provide a shipping receptacle more especially designed for containing hats to be shipped by the manufacturer or jobber to the dealer without danger of crushing or otherwise injuring the hats. Another object is to permit of packing a large number of hats into a shipping case of a comparatively small size, and without first requiring individual packing of the hats.

MILK CAN SAFETY DEVICE.—G. H. VOGEL, 667 49th St., Brooklyn, N. Y. This invention relates to milk can covers and has for an object the provision of an arrangement whereby the lid is locked in position. Another object is to provide a combined locking and safety device for milk cans whereby when the device is operated the lid will be locked in place and also be prevented from entering the neck of the can too far.

LAMP SHADE AND SIMILAR PLAITED ARTICLE.—A. KRAUSS, address Louis Levi, 880 Broadway, care Levi Simson & Co., New York, N. Y. The object of the invention is to provide a lamp shade, doll's hat or similar plaited article, arranged to permit the user to quickly and conveniently enlarge or diminish the article in size to suit the user's desires. Another object is to securely hold the plaits in an adjusted position, to reinforce the plaits and to prevent distortion or limpness in damp weather.

SEPARABLE BUTTON.—A. J. LOBAR, care Strong Producing Co., 331 Fourth Ave., New York, N. Y. The object of the invention is to provide a separable button arranged to permit the manufacturer or user to conveniently fasten the button members together on clothes, leather, rubber or other material, or to disconnect the members for removal of the button from the article for reuse at the same or any other place; The device is very simple and durable in construction.

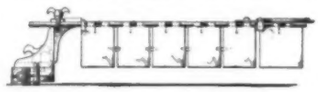
FASTENER.—J. V. WOODWORTH, 120 Broadway, New York, N. Y. This invention relates to snap fasteners of the stud and spring member type; its object is to provide a fastener, arranged to easily press the stud into engagement with the spring member and prevent accidental disengagement. Another object is to provide resilient retaining members capable of yielding easily in one direction and to restrain the spring from yielding easily in an opposite direction thus requiring considerable force to disengage the stud.

FOLDING SWING CHAIR.—A. F. BAILLY, 15 Ward Ave., Trenton, N. J. This invention relates particularly to a folding chair or cot adapted to be adjusted for use in either sitting, reclining or any intermediate state, being adapted to be folded into very small space for storage purposes and one which is designed with means for causing the swinging thereof by a simple and convenient foot manipulation independent, however, of the floor or other stationary object.

Hardware and Tools

ANIMAL SHEARS.—E. S. BARTLETT, SR., Box 1422, Butte, Mont. The invention has for its object to provide mechanism for connecting the shears with the operating mechanism, and for connecting the operating fork with the blade. The present invention is an improvement over Patent No. 1,299,379 granted to the same inventor December 19th, 1916, and the device comprises a casing having a removable cover held in place by screws, and provided at its outer end with a hood or dome portion in which is housed the tensioning device, the subject-matter of the aforesaid patent.

JOINTER GUARD.—J. A. DENOON, 607 Masten St., Buffalo, N. Y. The invention has for its object to provide a device of the character specified for guarding the cutting blades of a jointer to prevent injury to the fingers of the



A FRONT VIEW OF THE GUARD

operator. The guard can be installed on any machine, and does not need changing for different stock. Material from one to three inches may be jointed without raising the guard. When it is desired to sharpen the knives, the guard may be swung to one side.

SAW HANDLE.—C. S. B. HENRY, South Bend, Wash. The invention relates generally to saw handles and more particularly to a saw handle for double end cross cutting saws capable of ready and quick attachment and detachment, the object being to provide a construction of the several parts whereby the connection may be rigidly maintained at all times.

Machines and Mechanical Devices

MACHINE FOR MEASURING AND WINDING WALL PAPER IN COMMERCIAL ROLLS.—J. CROWE, 2713 Duncan St., St. Joseph, Mo. The invention relates particularly to a machine for winding rolls of wall paper, from what is known as "jumbo rolls" in which form the paper is supplied to wholesalers from the factory. The primary object is to provide a machine which will act continuously in a wholly automatic manner to wind and discharge the rolls as wound, and reset the parts for each subsequent roll.

HORIZONTAL BORING, DRILLING, MILLING AND TAPPING MACHINE.—W. W. F. MCCARTY, Defiance, Ohio. The invention relates to metal working machines; its object is to provide a machine more especially designed for heavy service and arranged to permit the operator to readily change the speed of the spindle or arbor according to the nature of the work to be done at the times and without danger of stripping the teeth of the gear wheels of the speed changing gearing. Another object is to provide an automatic, variable feed mechanism for the spindle, to feed the latter at a desired speed.

Musical Devices

SOUND BOX MOUNTING.—W. T. LAKIN, Long, Md. The invention relates to phonographic tone arms. An object is to provide a tone arm including as one of the essential features a conduit, so mounted upon the end of the tone arm as to be capable of being swung completely back out of the way, making the turn table accessible for the placing and removing of the records. Another object is to provide a reproducer neck, adjustably mounted upon the end of the sound conduit, adaptable to both vertical and laterally cut records.

Railways and Their Accessories

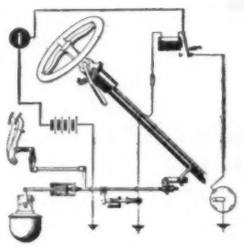
DRIFTING VALVE DEVICE FOR LOCOMOTIVES.—R. M. LICKLEY, 1890 Penrose Ave., East Cleveland, O. The object of the invention is to provide a means of supplying saturated steam from the boiler of the locomotive, independent of the regular throttle and connections to the steam chest when the said throttle is closed and the locomotive is moving either by its momentum or down grade. To accomplish this result use is made of a drifting valve connected with the steam chests and the boiler to supply saturated steam to the chest, the valve being provided with an automatic shut-off to close when the steam in the steam chest reaches a predetermined pressure.

Pertaining to Vehicles

NON SKID FOR TRUCKS.—F. HUDA, 469 Division St., Perth Amboy, N. J. The invention has particular reference to means for applying non-skid chains, or their equivalent to commercial truck wheels. Among the objects of the invention is to provide an attachment for the felly of a truck wheel, said attachment providing means for quickly attaching to the same a flexible chain device and for similarly detaching the chain therefrom according to the weather or the conditions of the road.

TIRE GAGE.—H. MCN. SHWAB, care Geo. A. Dickel & Co., Louisville, Ky. This invention relates to gages for pneumatic tires, and has for an object the provision of an arrangement which may be attached at any time to an ordinary valve now in use for indicating the air pressure in the tire. Another object is to provide the means whereby the tire may be pumped while the gage is in place and indicate during the pumping operation the air pressure in the tire.

AUTOMATIC IGNITION CONTROL.—W. M. EDMONT, 18 Third Avenue West, Duluth, Minn. The invention relates to electric circuit controlling mechanism for use in connection with the ignition circuit of an automobile engine. An object is to provide an ignition cut off for an auto-

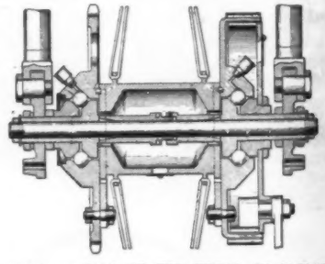


DIAGRAMMATIC VIEW SHOWING AUTOMATIC CUT-OUT MECHANISM

mobile engine which is operatively combined with the throttle valve operating mechanism in such a manner that upon closing the throttle, the ignition circuit is automatically broken, rendering the engine "dead" and causing it to run against the compression in the cylinders thus providing an effective brake.

JACK.—H. D. REY, Island of Rarotonga, Cook Islands, New Zealand. The invention relates to jacks of the screw operated type, wherein pairs of toggle levers are provided, having at one end a base and at the other end a head for engaging the object to be lifted, the screw having threaded engagement with one pair of the levers, and a rotatable engagement with the other at the connection of the members of the pairs, for moving the connections toward and from each other when the screw is rotated.

DEMOUNTABLE AND INTERCHANGEABLE WHEEL FOR MOTOR CYCLES.—D. L. HICKS, Hicksville, L. I., N. Y. The object of the invention is to provide an interchangeable wheel arranged to permit convenient and quick



A CROSS SECTION OF THE WHEEL IN POSITION

removal of the rear traction wheel for repairs or other purposes without disturbing the driving means or the brake mechanism. Another object is to permit of interchanging the rear traction wheel of the motor cycle for the front or steering wheel whenever desired.

Designs

DESIGN FOR A SHOE RETAINER.—V. BENEDETTI, Abbott Blvd., Palisade, N. Y.

DESIGN FOR A SMOKER'S OUTDOOR LIGHTING DEVICE.—J. R. HARRIS, 3420 Parkview Ave., Pittsburgh, Pa.

Many a Man Thinks His Full Duty Done When He Takes Out Fire Insurance

He thinks he cannot lose. If the worst comes, he is safe.

He is vitally wrong.

A fire insurance policy is only a provision for regaining the value of property destroyed by fire. It is not protection against fire.

The whole loss caused by a fire cannot be repaid. "Fully insured" restores only the physical loss. The attendant losses—perhaps more serious—are not made good.

He should insure *against* fire—so far as humanly possible—to prevent a fire occurring. That is the only way to be secure.

When he buys a Hartford policy, he pays for fire protection, but he *gets* full protection only when he performs his part. He ought to observe every precaution—and the Hartford agrees to tell him what precautions to observe. But he must see that these precautions are enforced if he would do all he can to save himself from fire.

Whether you are a policy holder or not the Hartford is helping to protect you against fire.

Its inspectors and engineers are inspecting buildings in your neighborhood, suggesting methods for reducing fire hazards and installing and supervising apparatus for extinguishing fire as well as introducing safer systems of manufacture and operation.

This constant work of systematic fire prevention is operating to save your property though you may be setting all these conserving efforts at naught by unthinking carelessness of omission or commission.

The Hartford serves first by helping you to prevent fires; second by making good the value of property actually destroyed by fire.

Are you making the most of the double service of the Hartford?

Any agent or broker can get you a policy in the

HARTFORD FIRE INSURANCE CO.

The Two Hartfords—the Hartford Fire Insurance Co. and the Hartford Accident and Indemnity Co. write practically every form of insurance except life.

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Hartford, Conn.

Receiving Wireless Messages on a Paper Ribbon

(Continued from page 623)

speed messages are secret messages to all who are not equipped with this device.

A commercial phase of the speed question is peculiarly linked up with the atmospheric electricity phenomena of the north temperate zone. For years it has been found that the best time for transmitting all wireless messages between America and Europe is from 4 A. M. to 10 A. M. Speedy sending and receiving can condense the traffic into this most favorable period, or a greater volume can be sent with a minimum number of stations. When it is remembered that a pair of stations—one in Europe and one here—can easily cost $2,000,000, the item of keeping down overhead charges by rapid sending will be easily appreciated.

Now expert operators have been known to receive 35 words per minute for a short time under perfect conditions; but the average reception up to this time has been 15 to 20 words per minute—or roughly 1,000 words per hour. It has been a race between sending and receiving speeds in the past; in fact, prior to this invention it has been possible to send much faster than one could receive. But Mr. Hoxie's invention has reversed the situation, with a receiving instrument that records even faster than a transmitter can be operated.

The photographic recorder has been in daily operation at Bar Harbor, Me., for some time. It has repeatedly recorded regular traffic schedules ranging from 1,000 to 7,000 words without interruption; and at a speed of 40 to 55 words per minute every word is perfect, and easily and quickly read. It is used supplementary to the ordinary type of receiving set. Not only is the message permanently recorded on a tape of special photographic paper, but a fleeting visual image of the signals can be seen on the ground glass of the machine at the same instant that the electric impulses arrive from the antenna. And even more than this, an audible reception can also be made simultaneously by the regular telephone method.

The mechanism of the new recorder is based on a comparatively simple principle known to all electricians. A light-weight mirror "flutters" in electro-magnetic tune with the minute electric impulses coming from the receiving antenna. The duration and extent of the mirror's oscillations vary according to the dot, dash, or silence of the sending station. The mirror reflects a beam of light on to the moving sensitized tape. This tape, propelled by an electric motor, progresses up and down through vertical pipes which contain the developing and fixing chemicals. Automatically, the tape passes through the developing solution and then the hypo fixing bath, after which it is washed in running water and then dried by electric heaters assisted by forced draft—all processes, of course, being invisibly effected inside this single machine. As in the case of the stock ticker, the messages pour out of the recorder and into a basket. In rapid receiving there is an average of one word for every inch of tape. The receiving operators can read the record at a speed of 50 to 100 words per minute. The time to record, develop, fix, wash, and dry the tape is from two to four minutes. The rolls of tape are 1,000 feet long, and a continuous message of 10,000 words can be recorded without reloading the machine.

According to Mr. Hoxie, in describing a recent test, two simultaneous messages from different sources were coming into one receiving circuit connected to the new photographic recorder. One of these messages was sent at a train frequency of 1,000 cycles per second, and the other at 975 cycles per second. Ordinarily, two frequencies so close to each other would have interfered with reception; but by the manipulation of the usual tuning arrangement it became possible to pick up either message at will and record it on the

(Continued on page 640)

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Conveying—1919 B. C. and 1919 A. D.

The patient burden bearers of ancient times little dreamed of the modern belt conveyor that would one day lift the burdens from the shoulders of mankind.

To-day there is scarcely an article which you use that has not made some part of its journey to you over a rubber belt conveyor. The coal in your cellar, the sugar in your larder, the grain in your bread, the gravel on your walks, the cement and other materials in your house—these and countless other items have at some stage been handled on belt conveyors.

UNITED STATES RUBBER conveyor belts not only relieve the burdens of human beings, but they reduce the cost of handling materials to the minimum. The heaviest materials are moved at less than one-half cent per ton cost of handling.

We have now developed the manufacture of rubber conveyor belts to such a fine point that each class of materials conveyed has its appropriate cover of the proper thickness and consistency to withstand the service it has to perform.

Wherever materials must be transferred short distances at the minimum of expense and the maximum of speed, belt conveyors will quickly prove their economy and efficiency.

Wherever belt conveyors are used, the UNITED STATES RUBBER COMPANY'S conveyor belts will prove most satisfactory and economical.

United States Rubber Company

U.S. Rubber Conveyor Belts Are Good Belts

Receiving Wireless Messages on a Paper Ribbon

(*Continued from page 638*)

tape. In the no distant future Mr. Hoxie predicts a wireless station equipped with a single aerial but with several photographic recorders, each tuned to some long-distance station. Thus as the messages are received from the various stations, each recorder will take down the message from its own particular station.

Invention as the Foundation of the Nation's Wealth

(*Continued from page 625*)

Depoele, first trolley car; Lay, dirigible torpedo boat; Brush, arc light; and Howe, sewing machine.

Charts showed the growth of the patent work in the United States. It is very interesting to find that not until 1867 did we pass 10,000 patents per year (now we issue almost 50,000 yearly). The automatic telephone exhibit and the coal-tar cases were shown as examples of industries which exist literally on a foundation of patents—the one with 1,066 different patents, the other with 2,492.

As an education in patents the exhibition was an emphatic success. Many curiosities were exhibited, such as a patent signed by Thomas Jefferson; also the only patent saved from the patent office fire of 1836, to one J. Snyder, for a stove, and many quaint colored drawings of early inventions.

There has been from time to time a movement to establish at the Nation's Capital a permanent exhibit which shall be both of the work of each state, maintained by that state, and the work of the government maintained by the government. As it is at present, a visitor might spend a year in the Capital and never have any conception of the work, for instance, of the Interior Department, just as not one in a thousand who come to the Capital have any idea of the extent, value or interest of the Patent Office. Such an exhibit as has just closed, which lays interesting, valuable and educational facts before the public, could be continued to the great benefit of those who form and maintain the government. As far as the patent office exhibit is concerned it could only be regarded as a keen stimulant to imagination, to invention, and to ambition to invent and patent. Inasmuch as practically all our national wealth which is not founded upon natural resources comes from industry reared on patents as foundations, and even the natural resources are mined and reaped largely by instrumentalities which are the results of invention, such a stimulation, governmentally maintained, would certainly be much in line with the government's idea of using its facilities for popular education. Incidentally it would help both patent office and inventors to a better understanding and therefore closer coöperation.

The Locomotive of the Seas

(*Continued from page 628*)

mobile is gently let down into place on this hull. For an electromobile of 4,500 horse-power, sufficient for a hull of 10,600 tons deadweight, the lifting force called for is less than 350 tons, and the length of time required to release the hull from the generating unit is 10 minutes. The dock is controlled and operated by a single man, and presents no technical difficulty of any sort.

The inventors of the Snell system are particularly interested in the problem of coal transport. Before the war there were annually shipped from the Tyne to London some 900,000 tons of coal. With the Snell installation it would be sufficient for this traffic to have 24 hulls of 1,200 tons deadweight each, and 8 electromobiles, with two small floating docks, one on the Tyne and the other at Gravesend. The estimated benefits would be very large. The single circumstance of dismounting the electromobile at Gravesend, and towing the hull the rest of the distance to London docks, would lead to a saving of a shilling per ton. In normal times the price of the entire fleet required, as above outlined, would be something like a million and a quarter dollars. The total saving per ton of coal transported, after making all necessary capital deductions, would be at least two shillings per ton. If the freight charge were reduced but sixpence per ton, the consumer would benefit to the extent of $100,000 in round numbers and the carrier would show an increased profit of three times that figure. It is not difficult to realize that similar economies would justify the establishment of the new system on a large scale.

Valuable By-Products from Gold Dredging

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and before long they had demonstrated the availability of their material for almost every kind of work in which crushed rock is used. It went into the construction of culverts and bridges, was used for ballasting the railroads, for the making of concrete houses and piers, and finally for road making. A second plant had been constructed near Sacramento, in the midst of the Folsom dredging area, and from the first material turned out by this second plant, an experimental stretch of public highway was constructed entirely of the crushed dredge tailings, and although that road has been constantly in use for several years it is still one of the finest and speediest roads in California. Today, the two plants turn out from two to three thousand tons of crushed rock a day, and this material, ranging in size from coarse dust to pieces weighing several pounds each, is used from one end of the Sacramento Valley to the other, and hundreds of men are employed in this by-product industry resulting from gold dredging operations.

In handling the dredge tailings at the rock crushing plants, the most economical methods are used, and a network of portable railroads reaches to every tailings pile. The cobblestones are loaded into dump-cars by steam shovels, and as the material is excavated the land is left smooth and even, and with as much small material and soil on the surface as possible. And then it developed not only that a valuable product could be made from the dredge tailings, but that, after the larger stones and boulders were removed and the surface leveled, fruit trees and eucalypts could be made to thrive thereon. The deep plowing to which the land had been subjected by the dredging process enabled the roots of trees to penetrate to the water level beneath. At Folsom, an experimental plantation of eucalypts and olives was started, and from the very first it met with success, demonstrating that, under certain favorable conditions dredged-over lands can be reclaimed for horticultural purposes. Similar results were obtained at Oroville, and some of the finest fruits grown in that vicinity now come from what are termed "rock pile orchards."

Encouraged by their efforts to reclaim the lands, the dredge operators next turned their attention to devising a dredge that would automatically separate the various classes of material passing through the dredge, and dump the heavier stones on the bottom, with the finer material and silt on the top, so that it would be possible to leave the land suitable for raising crops.

On some of the newer types of dredges, a number of stackers were installed, and by the use of a number of moving belts, the material passing through the dredges is automatically separated and carried to the tailings pile by the appropriate stacker. These are so arranged that they can be lowered or raised, or moved from side to side at will, thus enabling the dredge-master to deposit the various classes of material as he desires. Even the mud-laden water, instead of being pumped overboard, as formerly, is conveyed by pipes to the top of the tailings pile and

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Valuable By-Products from Gold Dredging

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poured over the stones, so that the mud and fine particles of soil may find lodgment on top and be saved.

While it is not expected that even a large proportion of the dredging lands of California can be reclaimed by the processes herein described, yet the success so far met with and the efforts being made by the dredge men themselves encourage us to believe that as uses can be found for the lands thus mined, the means for rendering them available for use will be forthcoming. Unquestionably the larger proportion of the areas mined by the dredging process is unsuited for any other useful purpose. At the same time, the development of the process of dredging, whereby the land can be plowed up and the gold recovered, without seriously interfering with its permanent value for grazing or crop production, will mean that should new dredging fields be discovered in the future, they can be developed even though the surface of the lands is valuable for other purposes. As suitable dredging lands are worth from $1,000 to $20,000 an acre, even the very finest farm and orchard lands could be bought at fancy prices and dredged, after which the areas could be turned back to their former owners and used again for their original purposes. The practical consummation of this plan would entirely remove all hostile public sentiment against the dredging industry, on the ground that it destroys the land. This is a condition devoutly desired by every dredge operator in this country.

The United States Patent Office as a National Asset

By Edward Thomas

MANY people will be surprised to hear the United States Patent Office called an advertising agent, still it is not only that but an employment agency as well. The Patent Office does its advertising largely by publishing the names of inventors, and this publishing is done every week. Each Tuesday noon, the Patent Office mails to inventors or their attorneys somewhere between 700 and 1,000 patents, and at the same time it mails several thousand copies of the Patent Office Official Gazette which contains an index to all the inventions patented and published that week, besides the names of the inventors, and a brief summary of some features of the inventions. Some of these patents, together with the names of their inventors, are soon buried in obscurity, but by no means all of them, and probably only a small fraction of them, for each week the Patent Office Gazette goes into the offices of hundreds and perhaps thousands of manufacturing firms, and is there scanned eagerly for the "inventive news" of the week. Besides this the Gazette is read by hundreds of patent attorneys who are on the outlook for any bit of inventive information which may interest their clients. Any such information is passed along to the manufacturer or promoter whom the patent attorney thinks will be interested in it, and with that information goes the name of the inventor, whose ability is thus advertised to the parties interested in his invention.

For example, one inventor designed an admirable spring motor for a certain machine. A maker of another kind of machine saw the notice of the patent on this motor published in the Official Gazette, wrote to the inventor describing his needs, and asked the inventor what he could do in that line. The inventor not only solved the problem, but today is getting a royalty on the patent which solved the problem. Meantime another of his inventions was seen by another large manufacturer in another line, and obtained for him a good position as a professional inventor for that manufacturer. If it were not for the fact that most inventors put a very exaggerated estimate on the value of their inventions,

many more inventors would be agreeably surprised each week by inquiries about their inventions, and by receiving offers of new jobs.

Unfortunately many inventors find it difficult or impossible to work for other people, because if they have not already an exaggerated idea of their own importance, they soon acquire such an idea. Many employers, therefore, hesitate to approach an inventor directly with a view to hiring him, but use indirect methods of approach. But the manufacturer or promoter depends on the Patent Office for sorting out the really bright men from the ordinary run of people, for getting hold of the really bright men who will give him something that will seem new and useful to produce, or that will enable him to broaden the scope of utility of his products. In this way employees of factories, located remote from towns, are brought in touch with other manufacturers, especially with manufacturers who furnish the supplies, the machinery and the tools which they use in their round of daily work. The men in remote factories who have valuable ideas are often foremen, or workers at the machines, and it is only through patent attorneys and the Patent Office that they are able to come in touch with the machinery builders in distant cities.

Not only is the Patent Office an advertising agent or employment agency, but it also furnishes unprejudiced recommendations of the "help" on its advertising list. It does this because the Examiners of the Patent Office pass upon every application for a patent, and determine whether the ideas have sufficient novelty to entitle the applicant to a patent. Thus, every person who gets a patent has to run a certain mental gauntlet, and the ability to pass that gauntlet is no small recommendation of mental ability, or at least of originality. The publishing of the patented application spreads this recommendation far and wide through the Official Gazette which, as stated above, is published each week. Besides the names of the inventors, the Gazette contains a partial picture of each invention, and a rough abstract of the scope of the invention. Thus, the recommendations of the Patent Office are not mere statements that the person who gets a patent does satisfactory work, since, besides that implied compliment, the Patent Office picture is a specimen of the man's work, so that any one can judge of the character of the work. Further any one who wishes to know more about the details of a given invention can buy a copy of the whole patent for five cents by sending to the Patent Office.

Of course some people will object to my calling patents "recommendations," because of a widespread idea that many patents are useless. It will have to be admitted, however, that most of the recommendations submitted in answer to "help wanted" advertisements are useless, for few persons will hire help on written recommendations alone. So after all, a Patent Office recommendation has some advantage over any other, because of the specimen of inventive work which always is the basis of the patent or recommendation.

This "recommendation" function of the United States Patent Office is much more valuable in helping the progress of our country than is apparent at first sight, and is something peculiarly due to the United States patent law. In most other countries the inventor himself does not have to apply for a patent on his invention, but his employer can do and usually does the applying in his own name while practically concealing the name of the real inventor. But under the United States laws this concealing is forbidden, and therefore enterprising Americans of an ingenious turn of mind have a much better chance to get new and better jobs than do inventors in other countries. Because of this possibility of getting new jobs they often get "raised," to prevent their seeking new jobs.

A word should be added to allay the

doubters who think that United States patents are of dubious value because in about half the infringement suits the patents are held no good or not infringed. Anyone who thinks a moment will perceive that there are very few patent lawsuits in which each side does not believe that it has a chance of winning, for what is the good going to the expense of a suit if the result is a foregone conclusion? So patents of undoubted validity are seldom sued on, and for a similar reason patents which are known to be no good are seldom defended. The reason why there are more patent suits in America than in any other country is partly due to the small financial risk in bringing a United States suit, compared with an English suit, for example. In England the losing party has to pay the lawyers' fees for both sides, so that a man of moderate means seldom dares to sue a large corporation unless sure of winning. In the United States, however, the man who sues another cannot lose more than he is willing to pay his lawyer, so the American poor man has a somewhat better chance.

One illustration will suffice to show the risk of bringing a suit in England. The financial advisor to the owners of a valuable British patent, after they had sued a certain infringer and won, advised them to give the infringer a license at a price suggested by the latter—a very high price it would seem today. The owners refused to do this and decided to stop the infringer. The infringer, however, appealed and persuaded the Court of Appeals that the patent was void. The owners of the patent had to pay over to the infringers some $200,000 for the expense of defending the suit. Thus, the patentee was not only without his patent, but so much the poorer for having tried to enforce the validity of it. That could not happen in the United States.

In Germany, practically the only other large industrial country which has examiners pass on all patents issued by it, the patents mainly appear in the names of great corporations. Further, it is illegal there to have a lawsuit on the validity of a patent after its validity has not been attached during six years, so these circumstances are a bar to many German lawsuits on patents. Besides this, in most countries, large corporations usually have many criss-cross infringements of each other's patents and they settle for relative damages for criss-cross licenses without lawsuits.

The United States Patent Office and patent laws need improving, and there are several movements on foot to amend our patent laws to attain both these ends. It is to be hoped that in amending the laws, Congress will carefully keep in mind the necessity of preserving the advertising value of the United States Patent Office, and will be careful not to reduce the already too few advantages the American inventor has in getting his ideas before a world which is anxious to profit by every bright idea that can be successfully utilized.

Rabies and the Public Health Problem

FROM England on April 24th, there came to the American press sensational reports of an outbreak of rabies, so widespread that a condition akin to panic was created. Dealers in dog muzzles were swamped, and were accused of profiteering. Dogs were stoned in the streets, and owners put their special pets to death by painless processes. All this brings to mind very vividly England's remarkable record with reference to this disease, for it has been years since there has been a case of hydrophobia in the British Isles. This record suggests some important conclusions with reference to public health, as a world problem. England's remarkable showing is due to strict dog laws and their enforcement. From 1887 to 1896, there was an average of 238 cases of rabies a year in England. In 1901 a law was passed that all dogs imported into the country must be licensed. They were then quarantined under observation for six months by the government. All stray dogs were killed. As a result there has been no case of rabies in England since 1903 until the outbreak of April, 1919. It is rumored that the disease was introduced by soldeirs' dogs brought across the Channel in airplanes to evade the quarantine.

Fully to comprehend the importance of quarantine, as a protection to public health, one needs only to recall the cause of rabies and its means of transmission. A minute protozoan or one-celled animal, discovered by Negri in 1904, and named after him the Negri bodies, is the direct cause of the disease. The presence of these Negri bodies is detected in the brain or spinal cord of a suspected animal by mounting a portion of the brain or spinal cord on a microscopic slide and staining it with a particular fluid, called the Giemsa stain. This stain is taken up by the Negri bodies and differentiates them clearly from the other brain tissue. Their presence in the brain or spinal cord definitely determines the fact that the animal was a victim of rabies. This method of examining the brain or spinal cord of a dog, who has bitten some one, at once, instead of keeping the suspected animal under observation for a considerable time, enables the victim to begin treatment immediately, thus greatly increasing his chances of recovery. One of the results of the war has been that governments have taken up health activities on a scale never before attempted. The health of the community is no longer a question of the individual, but of the individual and his relation to his neighbor. The recent outbreak of hydrophobia in England after her long immunity, should give pause to New York city with a dog population of 500,000 and less than 100,000 of them licensed. In one year, 1915, moreover, there were over 3,500 persons in New York city bitten by dogs. No after-war problem is more important than this one of public health and the rigid enforcement of quarantine, that proved so effective in protecting England against the dread disease of rabies.

Metal Strapping on Wooden Boxes

ONE of the quickest and cheapest methods of adding to the strength of a wooden box is to wrap it with thin, flat metal straps. The ability of a box to withstand the hazards of transportation may thus be increased several hundred per cent. Tests made at the Forest Products Laboratory have provided some information as to how a box should be strapped to add most to its durability.

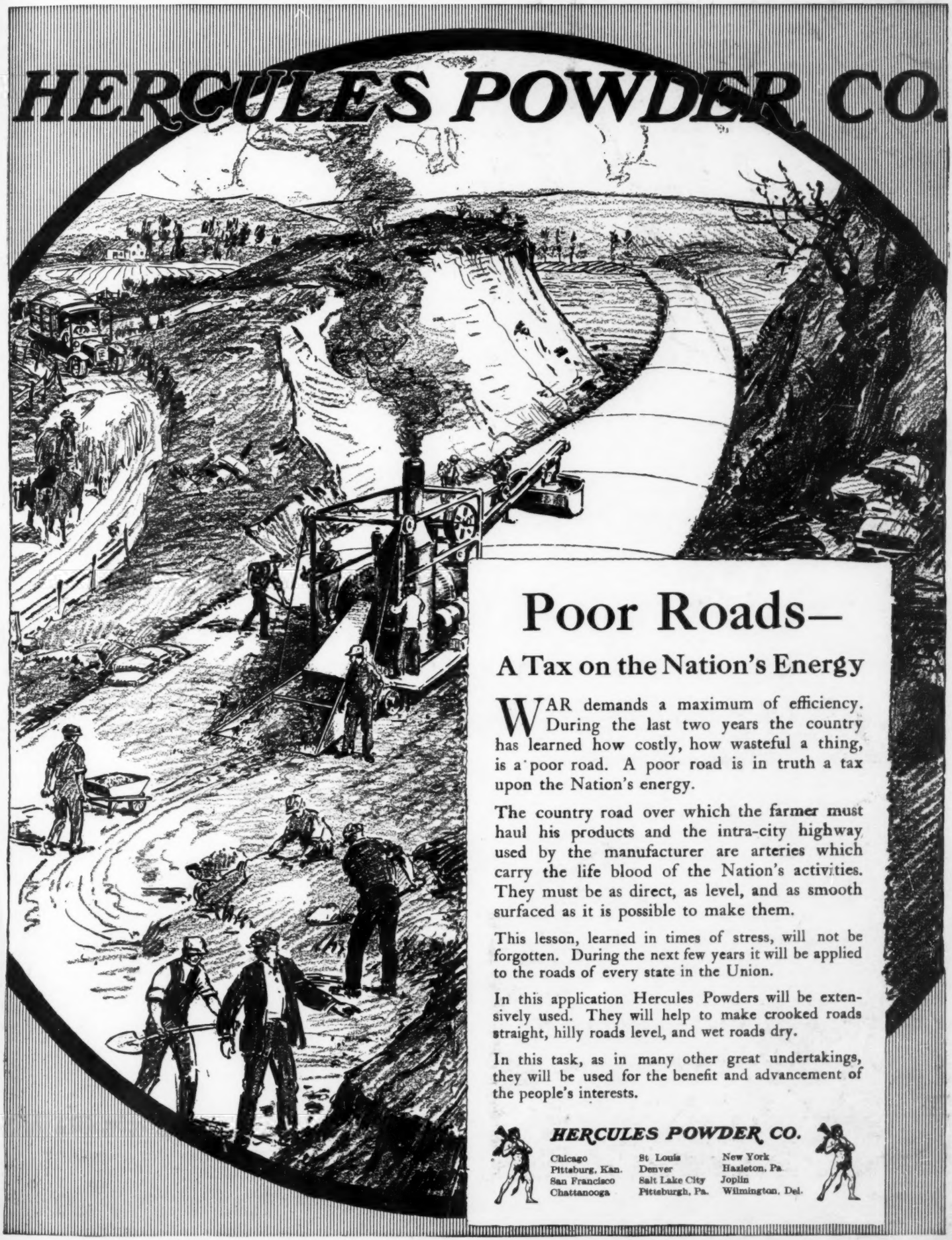
The best place to apply the strap is apparently about a quarter of the length of the box from the end. The strapping is preferably nailed at each edge of the box to hold it in place, having, of course, been drawn snug by special tools for that purpose.

Nailing the strap in place works well on boxes made of lumber ½-inch or more in thickness, but cannot be successfully used on thinner material because the nail splits the board. On thin boxes it is necessary to join the two ends of the strap (for which purpose there are several devices), thus making a metal band around the box held in place by tension.

Depending on tension alone to keep the strap in place is, however, open to one serious objection. Unless the box is constructed of dry lumber, shrinkage reduces its circumference to such an extent that the metal strap is no longer tight. This action not only reduces the effectiveness of the strap, but a shrinkage in moisture content of as little as 10 per cent will permit the straps to fall off when the boxes are subjected to the ordinary hazards of transportation.

The effect of shrinkage of the box is also serious when the straps are nailed at any point, since it causes them to buckle or "festoon." The reinforcing effect of the straps is thus diminished and the box becomes dangerous to handle.

HERCULES POWDER CO.



Poor Roads—

A Tax on the Nation's Energy

WAR demands a maximum of efficiency. During the last two years the country has learned how costly, how wasteful a thing, is a poor road. A poor road is in truth a tax upon the Nation's energy.

The country road over which the farmer must haul his products and the intra-city highway used by the manufacturer are arteries which carry the life blood of the Nation's activities. They must be as direct, as level, and as smooth surfaced as it is possible to make them.

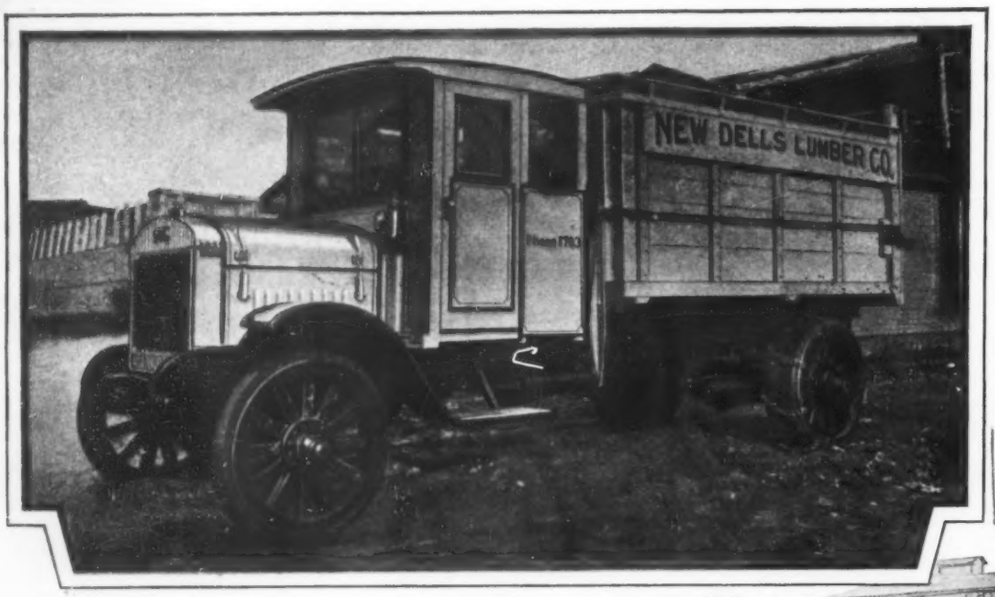
This lesson, learned in times of stress, will not be forgotten. During the next few years it will be applied to the roads of every state in the Union.

In this application Hercules Powders will be extensively used. They will help to make crooked roads straight, hilly roads level, and wet roads dry.

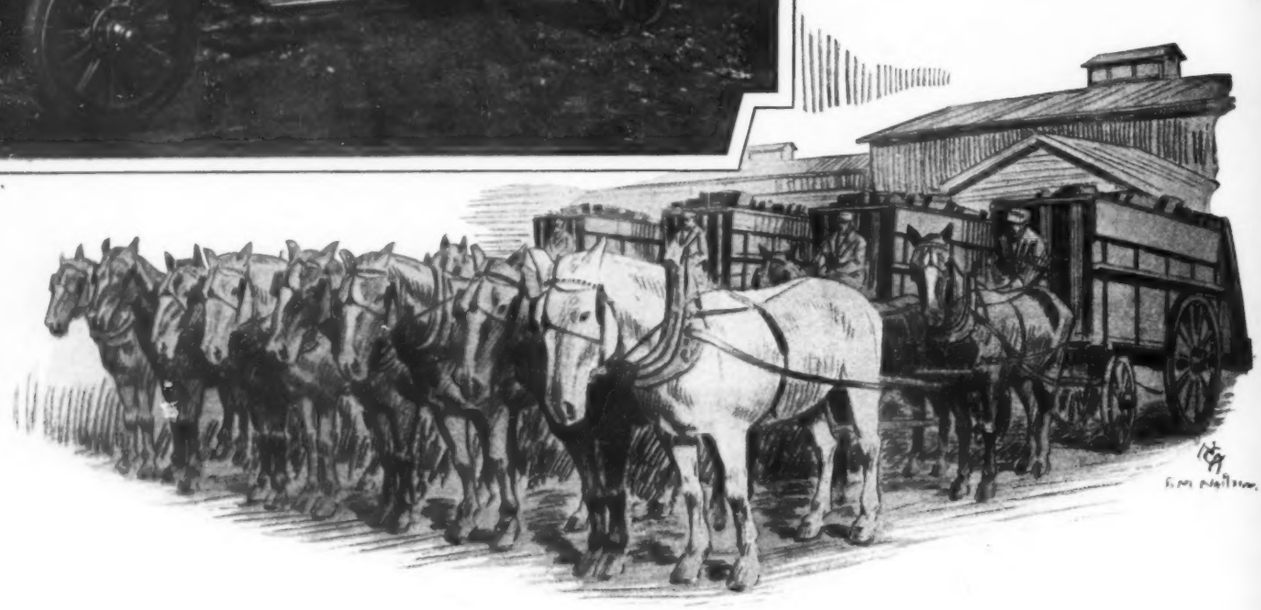
In this task, as in many other great undertakings, they will be used for the benefit and advancement of the people's interests.

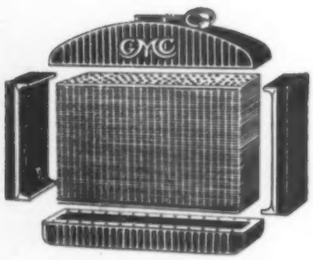
HERCULES POWDER CO.

Chicago	St. Louis	New York
Pittsburg, Kan.	Denver	Hazleton, Pa.
San Francisco	Salt Lake City	Joplin
Chattanooga	Pittsburgh, Pa.	Wilmington, Del.



GMC TRUCKS





For Example

Take radiator construction as an example of GMC thoroughness. This vertical-tube, continuous fin core is the most efficient known. It does not depend on solder for assembly strength. It is firmly bolted together. It rests on two brackets bolted to the chassis frame; no springs or dash-pots are used.

1 GMC; 1 Driver, Displace 16 Horses; 4 Drivers; 4 Wagons

One GMC and one driver are doing the work that 16 horses, 4 drivers and 4 wagons used to do for the New Dells Lumber Company, Eau Claire, Wisconsin.

Starting at 7 o'clock in the morning, this GMC truck makes 20 to 30 trips a day, delivering green mill wood over town under all conditions of weather.

It hauls 3½ tons at a load and is always on the job.

Estimate the cost of feeding, stabling, grooming and harnessing 16 horses. Figure the upkeep of four wagons.

Then figure the wages of four drivers, and consider the employment problem involved.

This is a typical example of GMC truck utility. Your business may be different, but among the GMC models, ranging from ¾ ton to 5 tons, is one admirably fitted for your work.

Behind every GMC is the backing of the General Motors Truck Company and its policy of plain, honest quality.

Let your next truck be a GMC.

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GMC TRUCKS